Issue 120
PS
1962 Series
THE PREVENTIVE MAINTENANCE MONTHLY
IT SAYS, ".. STORE PARTS AND ACCOMPLISH NECESSARY REPAIRS IN A WARM DRY BUILDING.."
2ND Bn. ECHELON REPAIR
SPECIAL COLD WEATHER ISSUE

THE FRIGID BREATH

You hear the howl of a thousand demons riding the driven wind a thousand miles straight from the Pole—the bottom drops out of your thermometer and you're floundering up to your waist in snow—and you're walking hand-in-hand with Death.

It makes no difference if you're bivouacked on the banks of the Danube, riding patrol along the Imjin, or scouting a crossing of the frozen Tannana:

As the thermometer goes down, the importance of Preventive Maintenance goes up—up to the point where PM in extreme cold is probably more critical than under any other weather conditions, anywhere in the world.

Why? Let's say that +75°F is a good, ideal, average temperature to work and operate in. Well, going into the desert at +120°F means you're all of 45 degrees beyond the ideal. But start back the other way. At —60°F, you and your gear have been thrown for a *135-degree loss!*

You've heard all about "a stitch in time saves nine." But in the cold, a stitch in time can save nine hundred. A two-minute check or a quick PM chore, done right, can head off a repair job—one that normally takes an hour but can stretch to a day when you're working with cold-soaked metal, brittle lines, and numb fingers.

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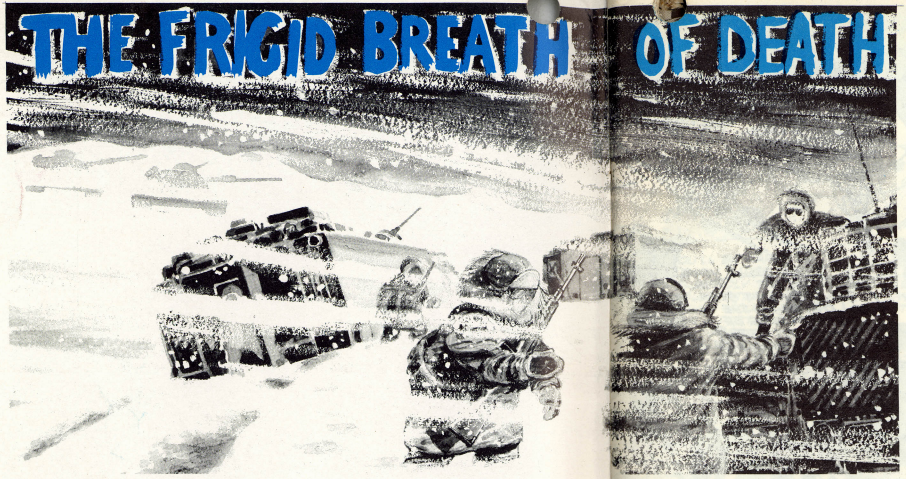
THE FRIGID BREATH OF DEATH



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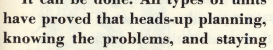
With your life—and your outfit's success—depending on the thickness of a sheet of canvas, or the dependability of a tent stove, or the power of a radio battery, or a vehicle that must move—the way to be sure is to prepare, not wait for repair.

It can be done. All types of units have proved that heads-up planning, knowing the problems, and staying on top of the little things, can add up to successful operation in the worst conditions you can imagine.

Preventive Maintenance in the cold can be your ticket back.

That icy wind whistling 'round your head isn't wind at all—it's the



PS THE PREVENTIVE MAINTENANCE MONTHLY

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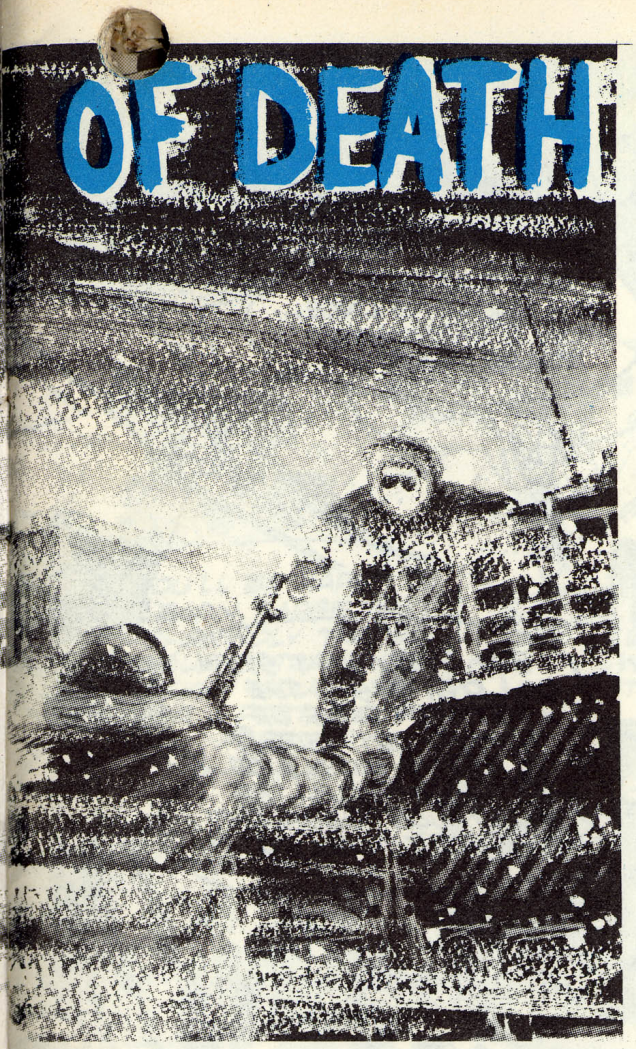

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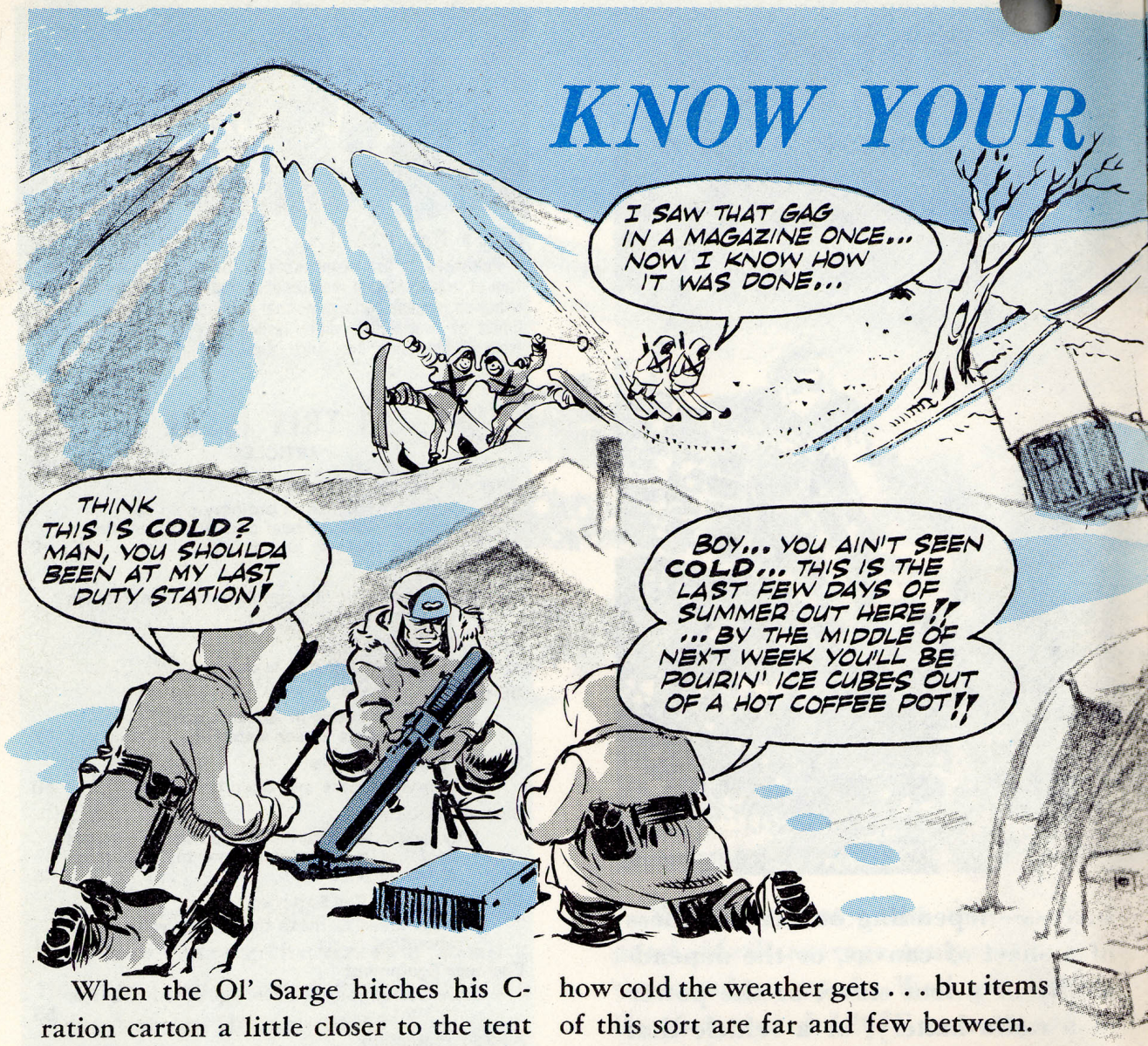
KNOW YOUR



When the Ol' Sarge hitches his C-ration carton a little closer to the tent stove, adjusts it another number, then rears back and allows as how it wasn't like this in the winter of '06—listen real close, else you might not catch what he means.

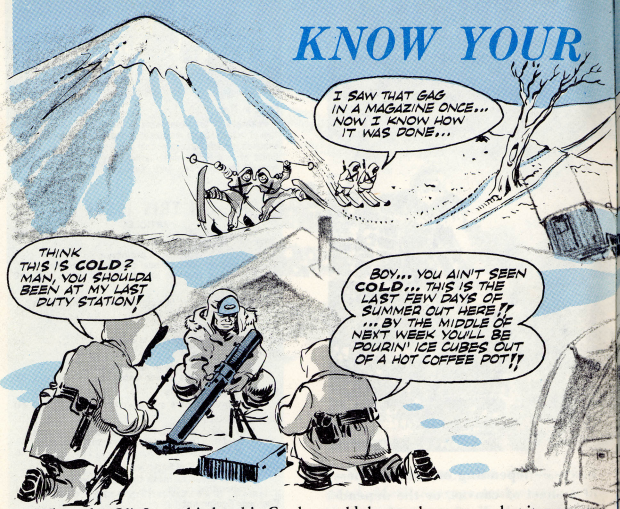
When he says "cold," he could be talkin' about plain, old ordinary cold (down to zero) or really cold (to ten below), but like as not he's getting around to jawing about extreme cold—where the thermometer can drop from −10° to −65°F like a one-way yo-yo.

Now, there are some items of Army equipment that could care less about how cold the weather gets . . . but items of this sort are far and few between.

Most equipment can get along in plain, ordinary cold, with just a little more care than it usually gets during shirt-sleeve weather. But when the bottom drops out of the thermometer, it's time for extra care and attention.

Equipment survival in extreme cold weather is a coupla three miles beyond what it takes for ordinary cold. In low-low temperatures, only good cold weather maintenance know-how and practices will turn the trick—and either you do it or you go without your equipment.

KNOW YOUR COLD



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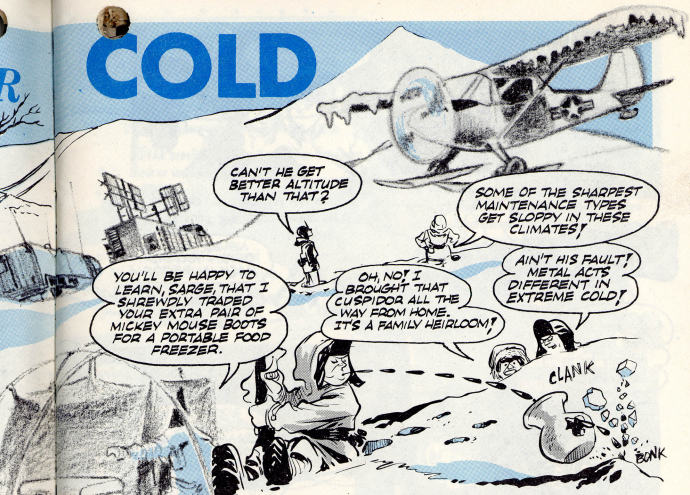


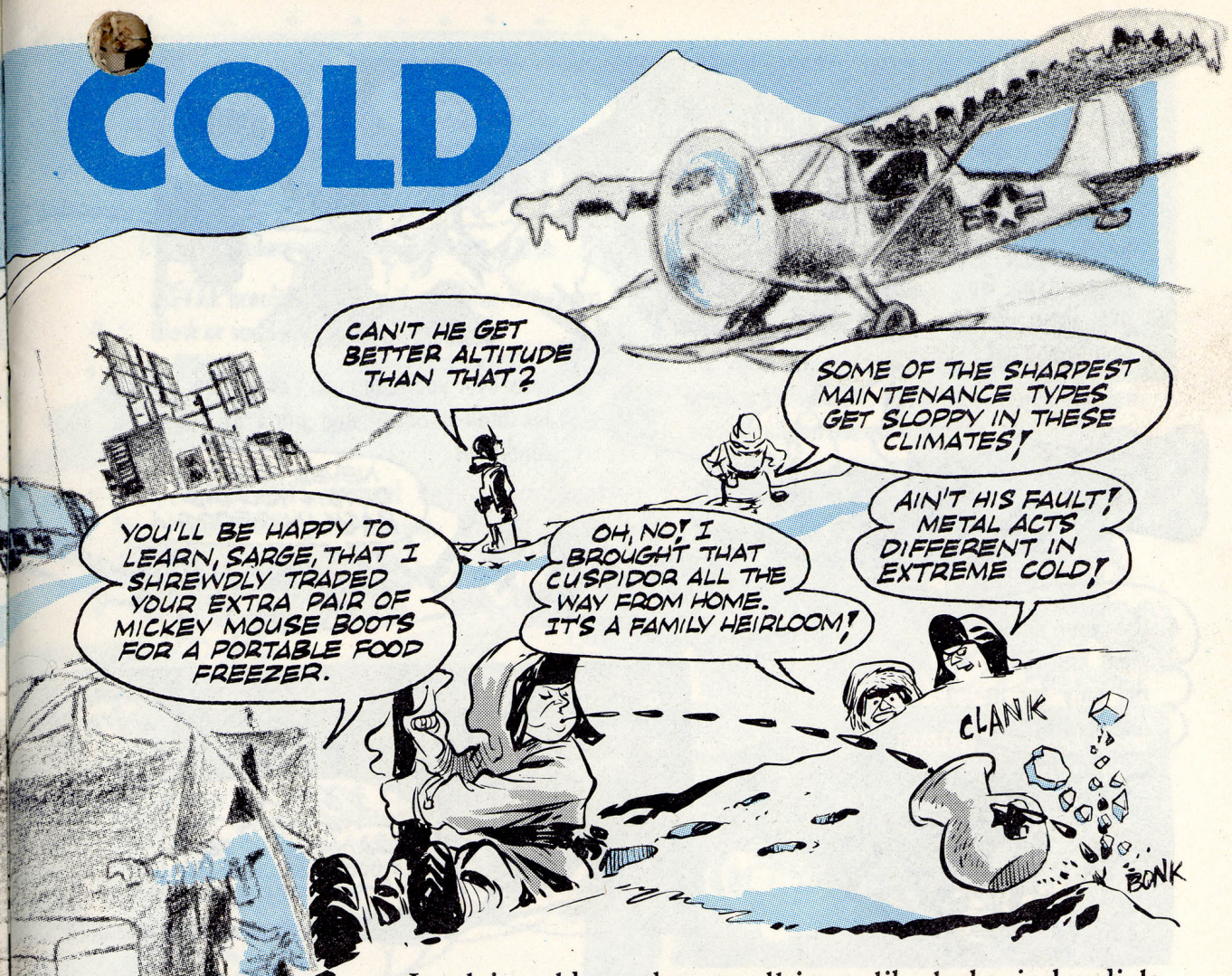
In plain cold weather, small items like locks, jacks, dials, watches and camera shutters that are made from a combination of different metals work with little or no noticeable effort. But using these same items in —20°F and below temperatures is another story. Their various metals contract at different ratios causing binding or misfits.

Only special care and attention to proper clearances when adjusting parts of this type will keep them in working condition. Just lubing won't free your contracted and binding parts. The only way to keep your equipment out of binds of this sort is to follow the basic rules . . . and here they are:

1. If you hear, see or smell anything unusual which is beyond your scope of maintenance, call your support immediately.

MORE

COLD



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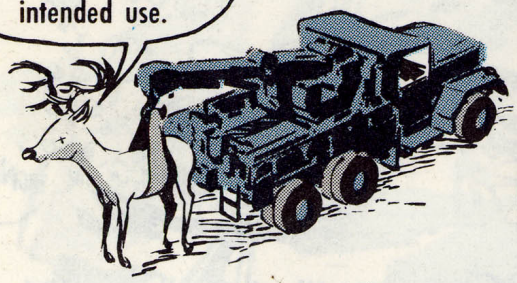
2. Keep your cold weather TM's, TB's, FM's and other important publications real handy for quick reference. Go over them every chance you get.

3. Follow cold weather instructions to the letter.

5. Look over your equipment every day. Look for broken or missing parts or unusual conditions.

4. Use your equipment and materiel only for its intended use.



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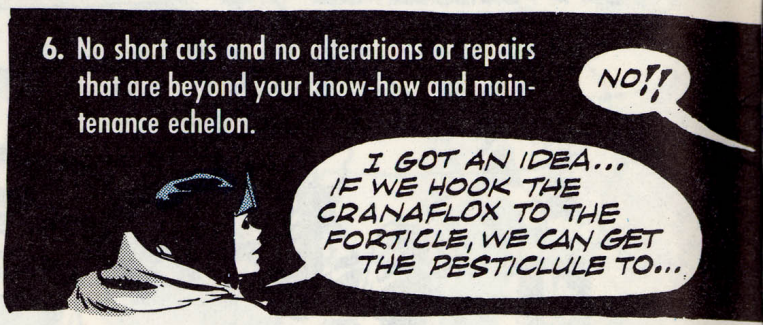
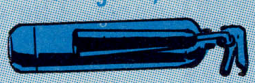


EXTREME COLD CONDITIONS

You'll run into many conditions that do not exist during your normal cold spells. Learning to recognize and accept these conditions as part of extreme cold weather living is the key to equipment survival. Here're a few of the many conditions you must expect and live with.

Carbon dioxide fire extinguishers don't operate very well in −40° temperatures; at −60°F they won't work at all. To keep your extinguishers in working order during extreme cold spells see your support unit about adding nitrogen to them. They have the know-how or can get it, on how to add enough nitrogen to withstand temperatures as low as −65°F.



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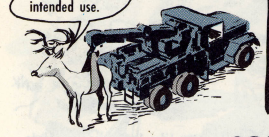

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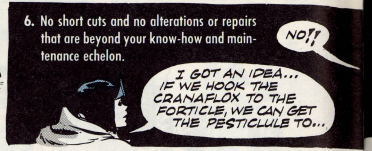

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PLASTIC windows crack and break when given a sharp knock or twist.

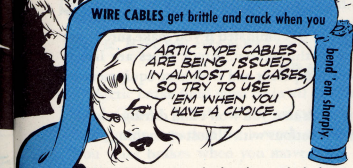
BEARINGS bind or could lock when not cleaned and packed with the right lube.

METAL breaks or cracks if you give it a sharp blow or sudden jerk.

TOW BARS, pins, hooks and pintles that're made out of solid metal will start snapping on you. Tubular tow bars and steel cables work a little better, but in all cases, hold down on the sudden bumps and jerks.

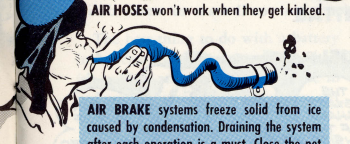
LUBRICANTS congeal and become hard – cause binding and locking.

WIRE CABLES get brittle and crack when you bend 'em sharply.



Control panel **INSTRUMENTS** get tricky and lie to you if they're frozen when you start up.

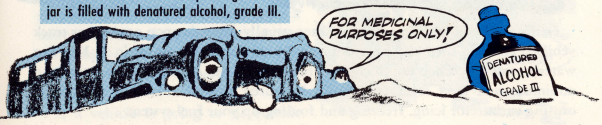
AIR HOSES won't work when they get kinked.



AIR BRAKE systems freeze solid from ice caused by condensation. Draining the system after each operation is a must. Close the pet cocks immediately after draining to keep 'em from freezing open. Check your alcohol evaporator set to make sure it's operating and the jar is filled with denatured alcohol, grade III.

If you get odd instrument readings, use the personnel heater or external hot-air sources to thaw 'em out.

In extreme cold weather when equipment sits, power trains stiffen up and brake bands freeze to the drums. Then, if you try to tow or drive 'em without first applying heat to the frozen parts, clutches, transmissions, differentials, PTO's and other parts'll start to let go on you. When she hits around –20°F



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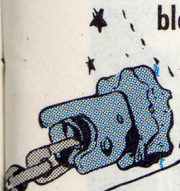

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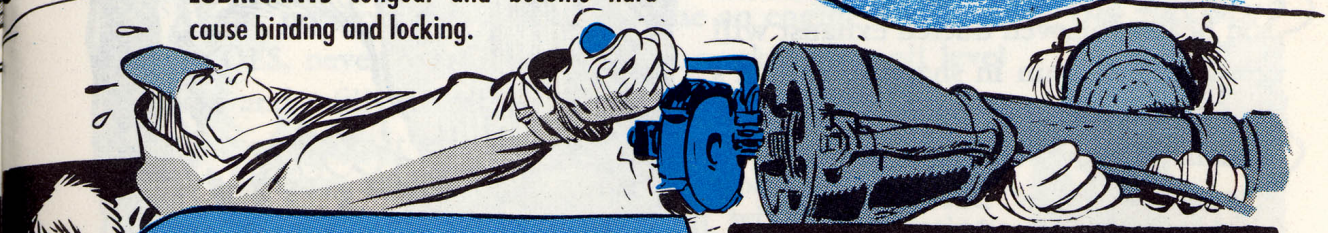

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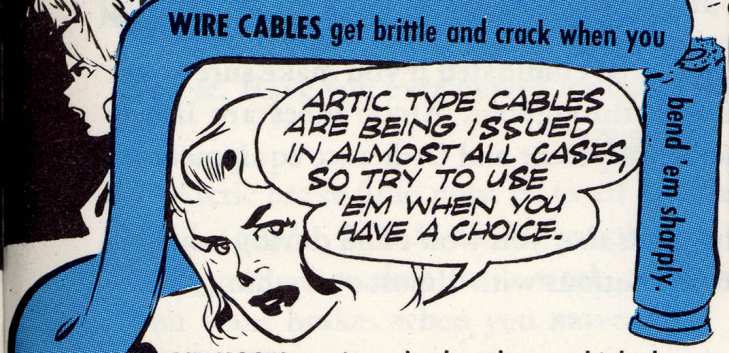

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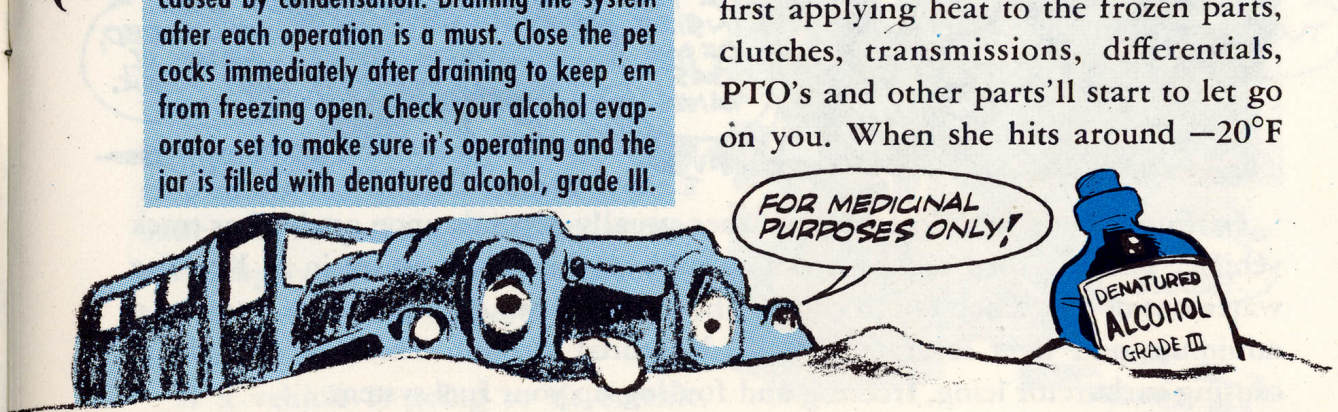


P.S. MORE

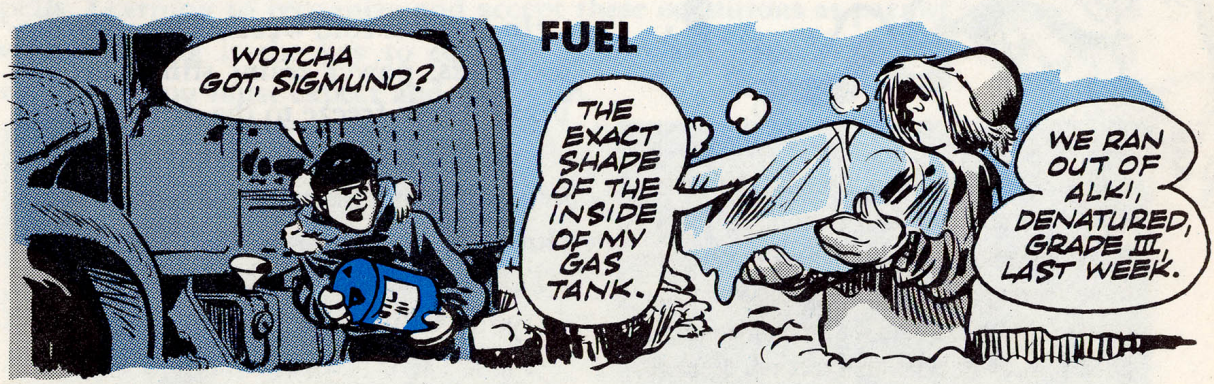
and —40°F, exercising—and that means moving—one vehicle or rig from each platoon every 3 hours for not less than 20 nor more than 45 continuous minutes. But as the cold deepens—say below —45°F—it's usually best not to shut off vehicles that must be kept available for use, and move them at least ten minutes out of every hour.

If you can't match that, remember that pre-warming a cold-soaked job with your M40 slave kit, Herman Nelson heater, or even ducted exhaust will get a power train in shape to roll. It's this cold-soaking of power train parts that makes tow-starting a sure road to damage—avoid it like the plague if there's any other way out.

A lot of cold weather starting troubles can be eliminated if you make sure your equipment is lubed with arctic lubricants throughout. Arctic lubes are listed in TB ENG 347 (4 Dec 59) for Engineer equipment and Ordnance equipment is covered in TM 9-207 (Sep 60).

There are many more of these touchy deals that you won't find during normal cold weather. In general . . . it's wise to be cautious with almost everything that's left out in low cold temperatures.

These are some of the major attention areas you'll want to watch during —20°F weather.



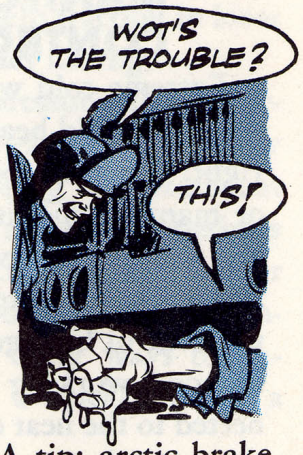
Getting around in deep freeze weather usually depends upon a wheel or track vehicle. These in turn rely on gasoline with no freezeable water in it. Keeping water out of gas is one tough chore. The best you can do is keep the water to a minimum and then saturate it with denatured alcohol. This'll keep it from causing carburetor icing, freezing and fouling up your fuel system.

OIL

When it comes to putting oil in your equipment, stick with your LO. Don't get involved in those coffee-break arguments or discussions over which oil is best in extreme cold. Take the experts' word for it . . . in the LO's.

Never substitute an oil for one called for by your LO. When it says to use OES instead of OE 10 . . . do it. But keep one thing in mind, when using OES, your engine will consume more oil. This means you'll have to check your engine oil level on the dipstick pretty often. Check it at every stop or every hour of operation. See page 37 of this issue for the story on OES and extreme cold crankcase lube problems.

Again, no short cuts . . . just because an engine consumes more OES, never overfill to cut short or skip your oil level checks and refills. Overfilling causes other troubles. Stick to the basic rule that says follow instructions to the letter.



While we're on the topic of oil, keep on the lookout for water (condensation) in your engine oil. Water will settle to the bottom of the crankcase, cover the oil sump screen and freeze. Have you ever moved ice cubes through an oil pump?

BRAKE FLUID

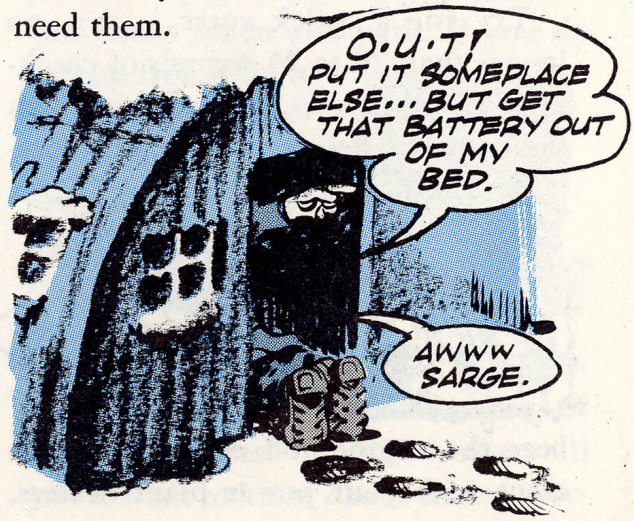
Arctic brake fluid must be in all hydraulic brake systems. A tip; arctic brake fluid (HBA) MIL-H-13910 evaporates (high alcohol content) when a piece of equipment is parked for a week or longer . . . so, check your HBA fluid level if you want brakes when you move out.

BATTERIES

The best thing to do with a battery in extreme cold is to sleep with it. Since it's no fun and not practical to be in bed with a battery, you best figure out some other way to keep it warm.

Keeping a battery warm is the only way to get at its maximum current, and your battery heating pads are your best regular bet. Cranking a cold-soaked engine needs the highest output from a battery. A fully charged battery at normal temperatures is only 60 percent efficient at −40°F and 50 percent efficient at −65°F.

If a vehicle is going to sit outside for several days, it may be a good idea to bring your batteries into your squad tent or any other warm area until you need them.



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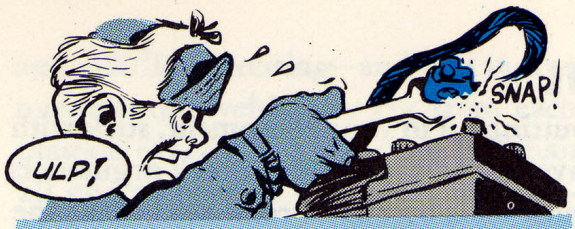


When removing a cold battery, be careful taking the cables loose. **Use two wrenches so no strain is put on the post or battery case.** Either could snap and break real easy. See page 46 of this issue for special tips on battery care.

MANIFOLD HEAT CONTROL VALVE

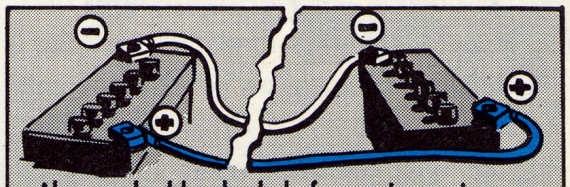
Extreme cold weather demands that your manifold heat control valve be set right. Whether you have the automatic or manual type, it should work freely and be set in the "winter" or "cold" position. On the automatic job, the vacuum control linkage and spring must be in good working condition, and connected to the heat control valve. On the manual job, it's up to you to set it in the "winter" or "cold" position.

STARTING

If you've got to start a cold-soaked engine direct from your batteries, make sure the batteries are at peak performance.

Try for a quick start . . . say, no longer than 20 to 25 seconds of cranking. If it won't start, stop cranking with the batteries. Before your next try, pre-

heat the engine and engine compartment with your, power plant heaters, M40 starting kit or your Herman Nelson heater. Then use a jumper or slave cable from your slave kit or from a fresh set of batteries.



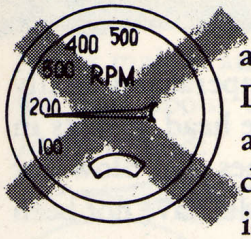
Always double check before using a jumper or slave cable that the positive post on one battery is hooked to the positive post of the other battery.

On some equipment you have a positive ground and some a negative ground. If you hook up a jumper cable to the wrong post, you've got yourself troubles; you'll most likely burn out a rectifier (on AC systems) and a voltage regulator.

When starting equipment that has an engine heater, always start the engine heater first. A cold and poor performing battery that won't crank a cold engine will usually start and run the gasoline fired engine heater. Then your preheated battery and the preheated engine'll make sweeter music for you.

Be on the lookout for hydrostatic lock when starting a cold soaked engine. Don't overprime . . . prime just enough to let the engine catch; don't flood it.

ENGINE IDLING



Engine idling at a a very low RPM is out. Low idling causes a a barrel of troubles so don't do it. If you must idle, keep your engine at **high idle**, which is about 1000 to 1200 RPM on most engines. Idling just for convenience can work out just the other way—it could increase your engine maintenance problems, and also put you in a sweat for enough fuel!

ANTIFREEZE

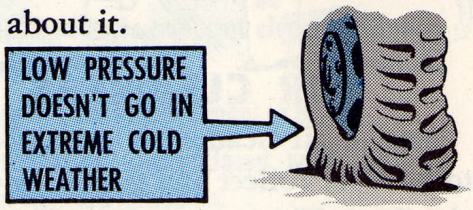
Never add water to arctic-type antifreeze. This seems to be general knowledge but you can get thrown for a loss if you don't drain your equipment's cooling system—completely.

Any water left in the bottom of the radiator, engine heater, battery pads and hoses will unbalance the antifreeze's prearranged proportioned mixture. This unwanted water that wouldn't matter much in ordinary cold will cause real trouble in deepfreeze weather. Do a complete job and drain all the water before putting in your arctic antifreeze and be sure.

For specific details on antifreeze, dig out your copy of TM 9-207 and go over page 32 for Ordnance equipment and TB Eng 347, page 4, for Engineer equipment. Also, follow the instruction printed on the antifreeze containers.

TIRES

Tires on your equipment need special attention in extreme cold weather and you'll even get arguments about how to go about it.

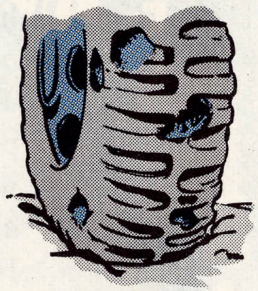


Decreasing tire pressures below normal will certainly help traction in loose snow—but it increases flexing.

Increasing tire pressure above normal reduces flexing—and flexing at low temperatures can bring on permanent tire cracks. So it's a choice sometimes between better traction or the danger of cracks. Go by your TM, but remember that there are other ways to improve traction and a cracked tire is a permanent thing.

Always be on the lookout for flat spots . . . if you get them, move out slowly until you work out the flats.

During sleet and freezing rain move your equipment every so often to keep their tires from freezing to the ground. Use dry tree limbs, brush or anything you can lay your mitts on, under tires and tracks when you park. If you do end up frozen tight and can't get a hot-air heat source, make sure you use a **blunt** tool to chip 'em out — don't gouge your tires.



Another TM you'll want is TM 9-1870-1, "Care and Maintenance of Pneumatic Tires." This TM covers all you'll want to know about chains, trac-

PS MORE

tion devices, air pressures and maintenance of tires. This TM is useful in all types of cold weather.

AIR CLEANERS

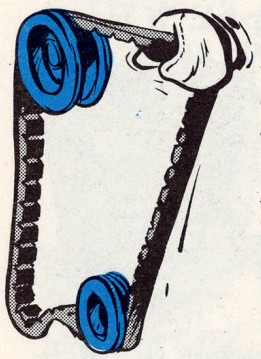
Engine air cleaners have been known to have ice collect and cut down on the air flow. This starvation effect will choke the engine and cause it to run rough or stop. For special air cleaner tricks and problems, squint at page 12 of this issue.

SPARK PLUGS

Keep your spark plugs gapped the way your equipment's TM calls it. This is true for all types of weather. There's an old story going around that in extreme cold weather you must gap them .005 inch less than specified in the TM. This is no longer true. Stick with the TM settings.

Here again if you have any questions or you want more dope on spark plugs, get a copy of TM 9-8638, "Spark Plugs Used on Ordnance Materiel."

GENERATOR PULLEYS



Generator pulleys have a habit of twisting off when cold-soaked. The only cure here is to preheat your generator with your M40 slave kit or Herman Nelson Heater. Even after you heat it, take no chances and stand clear when starting the engine . . . you never know. In temperatures above —40°F this is no problem.

ENGINE HEAD GASKETS

Since extra low temperatures really make metal shrink, the head gaskets in the L and F type engines will blow out or leak if their head bolts have not been torqued properly. The only way you can be certain your head gaskets will stay in good shape is to have the head bolts torqued as tight as the TM says . . . after the engine has been heated to its normal operating temperature.

WINDSHIELDS

Your windshield is another item that is different in extreme cold weather. Never warm it too fast. If you do, it'll crack and break, for sure.

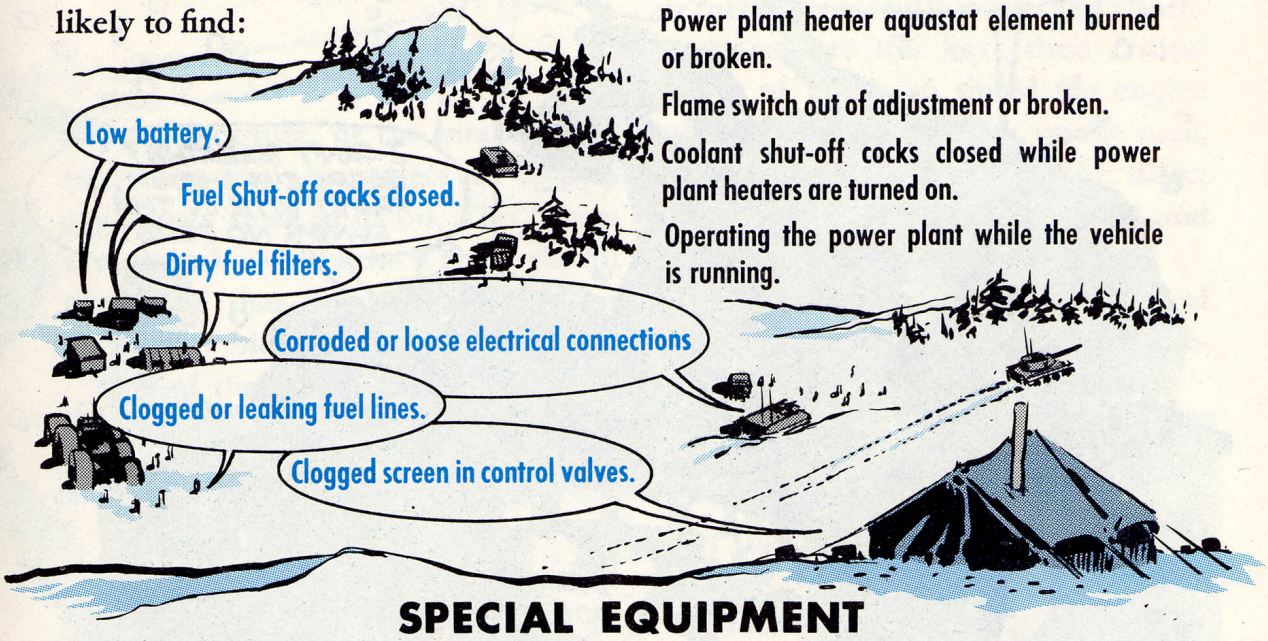
Always warm it gradually.

First heat the cab with your personnel heater. After the cab is warm, turn the heater defroster on low and let it spray on the windshield. Some outfits find it helpful to put a 4-in strip of tape across the inside bottom of the windshield. The tape acts as a heat shield and keeps the windshield from cracking when the heater defroster is turned on.

In temperatures below —10°F, never throw the full capacity of your heater defroster onto the windshield. Keep its force on low or medium.

HEATERS

You'll find that the power plant and personnel heaters come in several different makes and models. Since they're basically the same, their trouble spots are also about the same. Here's a run down on trouble spots you're most likely to find:



Power plant heater aquastat element burned or broken.

Flame switch out of adjustment or broken.

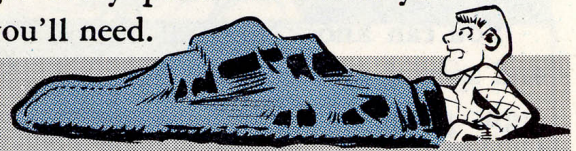
Coolant shut-off cocks closed while power plant heaters are turned on.

Operating the power plant while the vehicle is running.

SPECIAL EQUIPMENT

Equipment survival in extreme cold weather is usually not possible unless you have special winterization equipment. This equipment has been designed to help get you and your gun, tractor, crane, dozer, tank, truck or what-have-you through the tough cold periods. This special equipment could be heaters, blankets, special oils, slave kits, primer pumps, stoves, etc. The only sure way to know what you should have is to keep on top of DA Pamphlet 310-4.

It lists your equipment TM's, TB's, MWO's, SB's and LO's. These publications are your guide to the type of winterization equipment needed for your specific piece of equipment. It lists special publications on cold weather needs. Thumb through it and try to get every publication that you think you'll need.



Here're a few publications that are nice to have next to your sleeping bag:

FM 31-70 ..... Basic Arctic Manual

FM 31-71 ..... Operation in the Arctic

TM 9-207 ..... Operation & Maintenance of Ordnance Materiel in Extreme Cold Weather

TM 10-275 .... Cold Weather Clothing

SB 9-16 ..... Winterization Equipment for Automotive Equipment

TB Eng 347..... Winterization Techniques for Engineer Equipment

TB Ord 651 .... Use of Anti-Freeze

TB Ord 390 .... Cold-Weather Aid Kit (Slave Kit) M40

TB 9-2855 series Winterization Kits for Automotive Materiel

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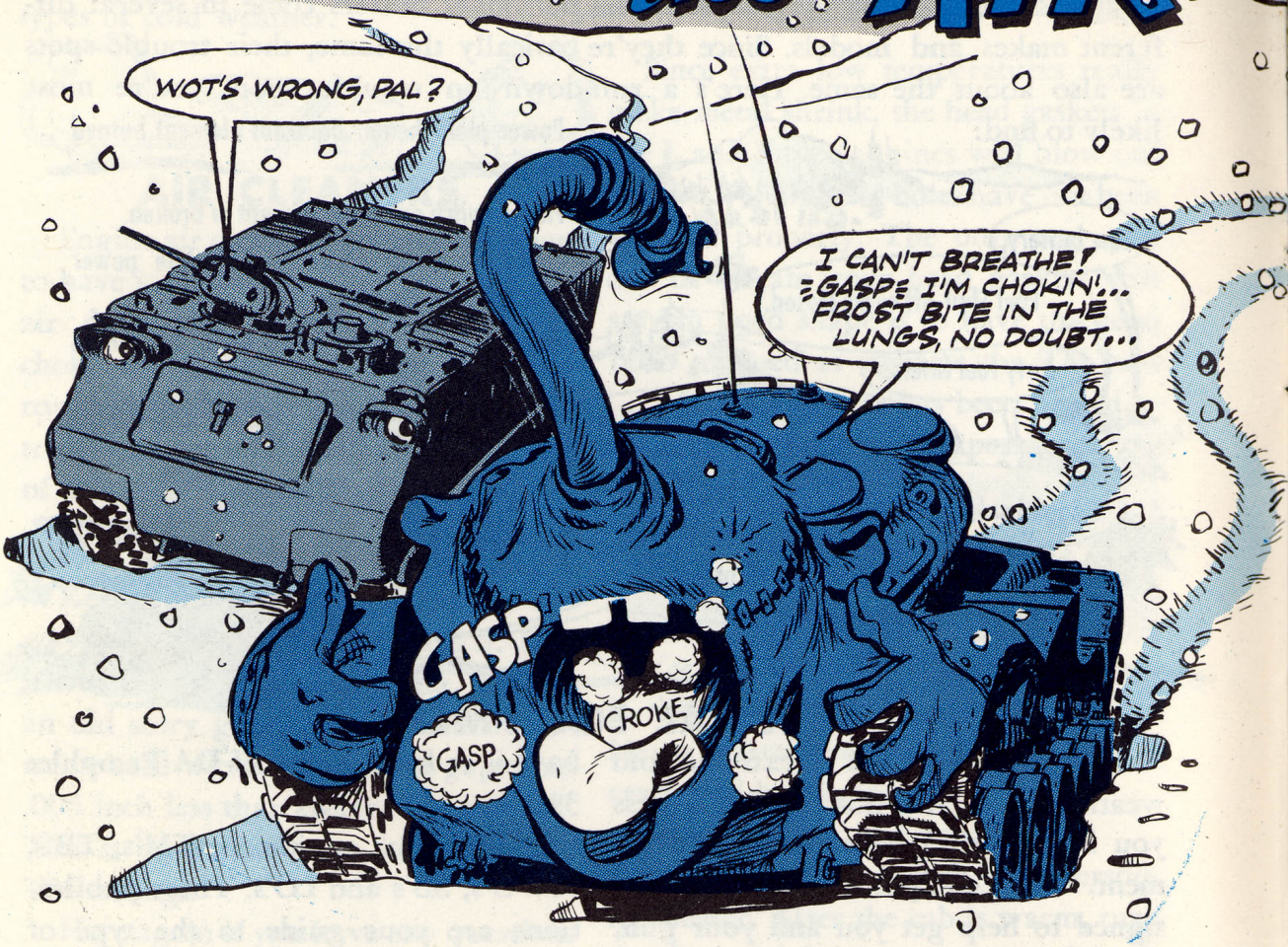
KEEP IT CLEAR . . . the AIR



Any internal combustion engine needs its supply of air—just as steady and just as clean—in sub-zero temperatures the same as it does anywhere else.

You can knock yourself out on PM and special cold weather care (use the right grade of fuel, properly mixed; keep the engine tuned-up just right—the carburetor adjusted to give a richer mix like the manual orders; pre-heat the engine, the lubes, the works), but it can all add up to a big fat zero, on some of your equipment, if the air intake stays unprotected and the air cleaner freezes-up on you.

When those icy winds (and even ice and snow) are drawn in, or blast into the air intake, the air cleaner can get it right in the kisser. And, when that happens it's got no choice . . . it begins to freeze-up, clog-up, and real soon the engine starts to lose power, gasp, and maybe even conk-out entirely.

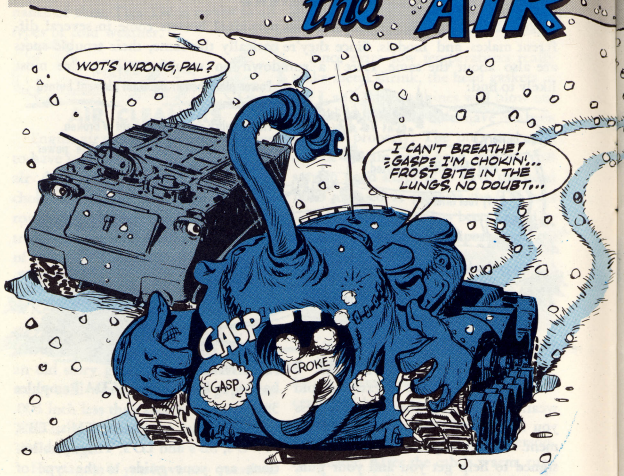
DOWN YOU GO

Under the right breezy freezy conditions, this problem can paralyze equipment with either the dry type or the oil bath type air cleaners.

For example, the oil-bath type air cleaner, in addition to icing-up from

KEEP IT CLEAR . . .

the AIR INTAKE



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DOWN YOU GO

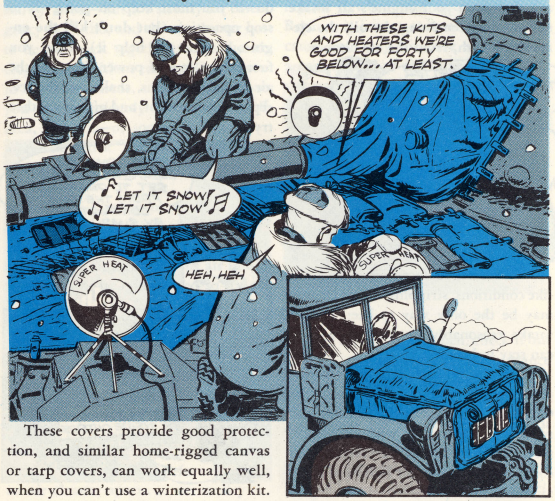
Under the right breezy freezy conditions, this problem can paralyze equipment with either the dry type or the oil bath type air cleaners.

For example, the oil-bath type air cleaner, in addition to icing-up from trapped moisture, or the intake of ice and snow, can also collect ice crystals and snowy slush in its oil. This'll congeal the oil, or it'll raise it above the fill level, and that can partly restrict or completely block the air flow.

One of the best ways to protect the air intake from chilly winds and weather, so engines can have their critical supply of air, is to shield the engine compartment and/or the intake area, as much as possible, from the direct blast of hard driven winds, ice and snow.

You can do it with whatever kind of flexible, sturdy, non-flammable material lends itself to your equipment.

Winterization kits, for example, for some equipment will give you covers for grilles, the hood, radiator, louvers, and other engine compartment vents which can be covered up.



These covers provide good protection, and similar home-rigged canvas or tarp covers, can work equally well, when you can't use a winterization kit.

MORE

INTAKE

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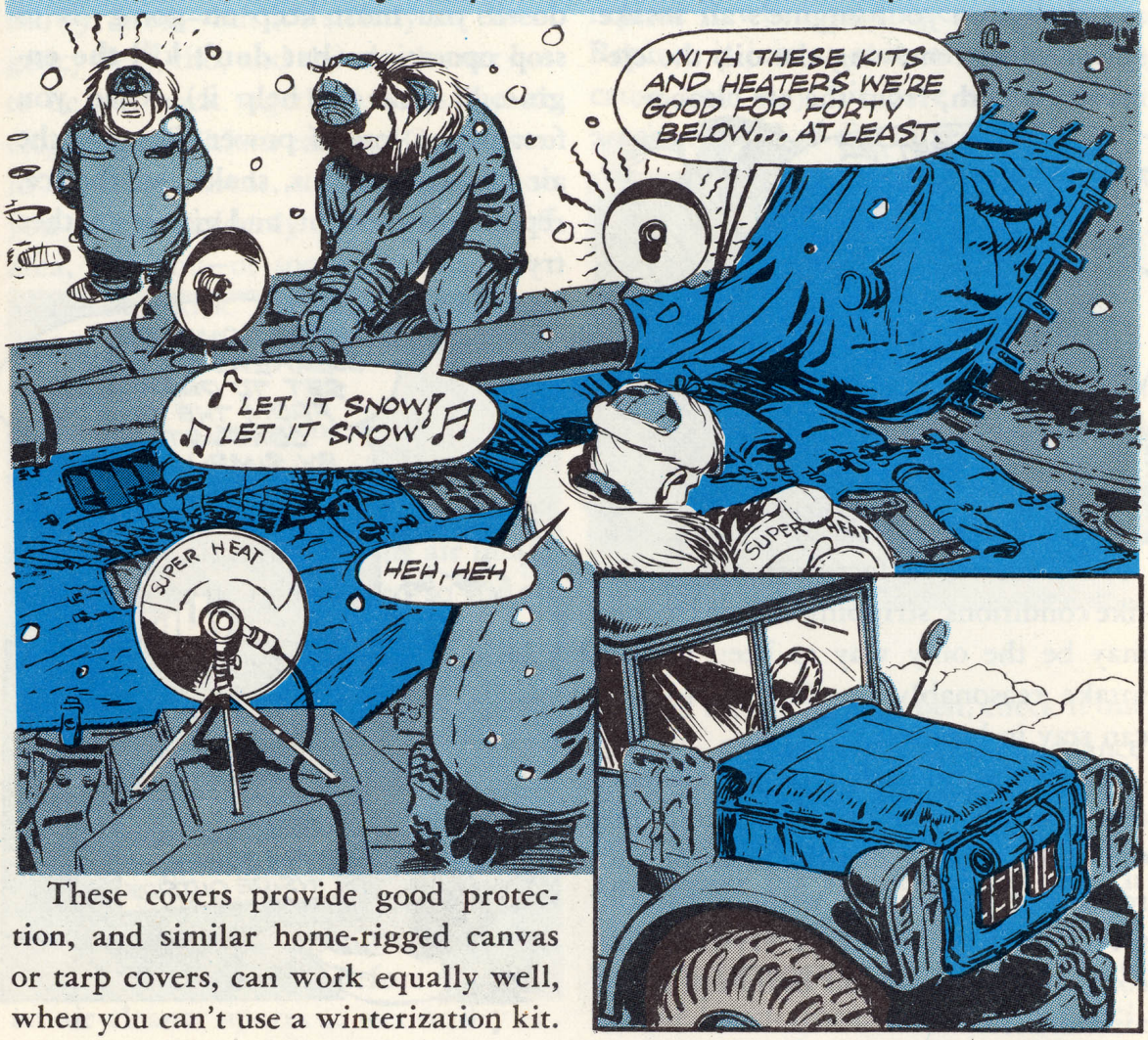

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PS MORE

On some equipment, in addition to covering the engine compartment top-side, it may also help to cover the engine's under-side. A piece of canvas stretched from side to side and firmly anchored to the frame, can help to eliminate ice and snow build-up in the engine compartment.

Keeping equipment facing down-wind, when possible . . . like when it's operating in a stationary spot, or parked, also offers some protection.

TO STAY UNCLOGGED

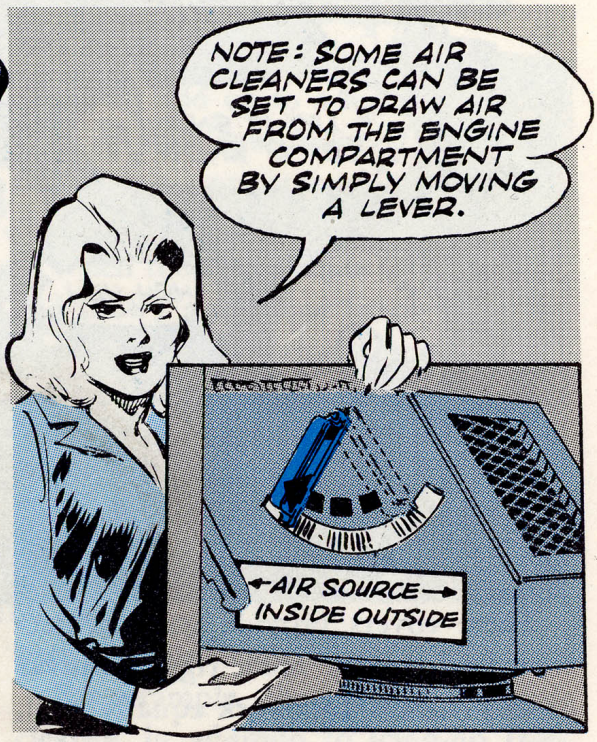
The air cleaner's job, of course, is to provide clean air for the combustible mixture, so the cylinder walls and pistons won't be damaged by the abrasive grit, dust, and such. In snowy, icy lands, however, where there is less of a dust problem, there may be times when you'll be authorized to make a temporary change in your engine's air intake system—like removing the oil, the element, or both, from the air cleaner.

As a matter of fact, in some Arctic-like conditions, stripping the air cleaner may be the only way to keep the air intake reasonably un-clogged, so you can stay in business.

With the oil-bath type air cleaner, for example, you can just dump the OES lube. Then clean the element and replace it. Operating without the oil solves the problem of ice crystals, and congealed or slushy oil build-up in the air cleaner.

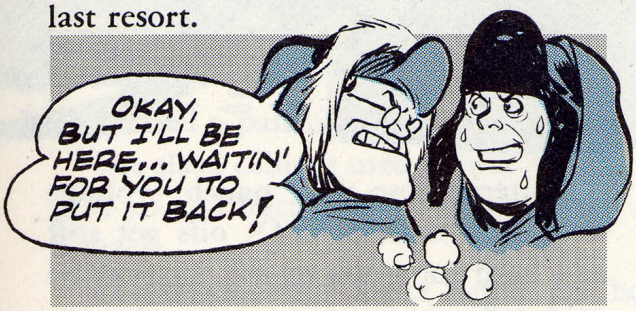
(NOTE: Leaving the element in place, while it won't be filtering as it normally does, will provide a trap of sorts – a change of direction—for the cold air.

If after removing the oil, making the engine compartment as tight as you can, and shielding the air intake, the air cleaner still fouls up, about all you can do—if you must keep on going—is to stop operation (but **don't kill the engine**, if you can help it) when you first notice loss of power. Remove the air cleaner element, shake out the ice, replace the element, and give it another try.



IF YOU GOTTA GO

In a case where you might be in a grand rush, or if you can't afford to keep stopping to clear out the element, you can just leave the thing out all together, and then replace it when your chore's done—but that's a panic-button last resort.

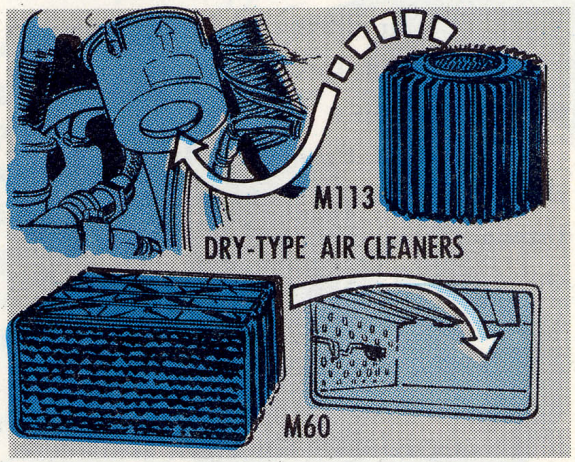


This is one way to keep going in icy, snowy, areas—but it's strictly an emergency deal, tho, and the air cleaner has to be put back together soon's the ice clogging conditions ease up. Cause even in the frozen areas, comes a time when you might suddenly hit a cleared off area, and you—or something else near you—can kick up dusty conditions which would be extremely harmful to an engine.

On some equipment with dry-type air cleaners, where the air intake normally comes through the operator's area (to the air cleaners) the air intake lines have to be re-arranged so the air

is taken from the engine compartment—during Arctic operations.

With this arrangement, and a snug engine compartment, the dry-type air cleaner gets a better chance of staying open. However, if a dry-air cleaner freezes and blocks the air intake . . . and you have to keep going, in an emergency you can remove the air cleaner element, stash it away, and then replace it when your operation's over. Replace it just as soon as you can, because you may hit bare spots, sandy areas or traces of dirt mixed with snow.



LIKE A SCOUT

This air-intake problem can hit you at the worst times. So, one of the best things you can do yourself on this score is . . . be prepared ahead of time. Check out local procedure on what's to be done on your particular type of equipment when it gets caught in such a bind.

And, by all means, before you pull an air cleaner apart . . . wet or dry . . . to keep the air intake open, check it out with the Old Man or your maintenance support outfit. And, also, when it's OK'd for equipment to operate without an air cleaner for any length of time, it should be tagged, with the caution "Air Cleaner Element Removed" in an easy-to-spot location on the instrument panel.

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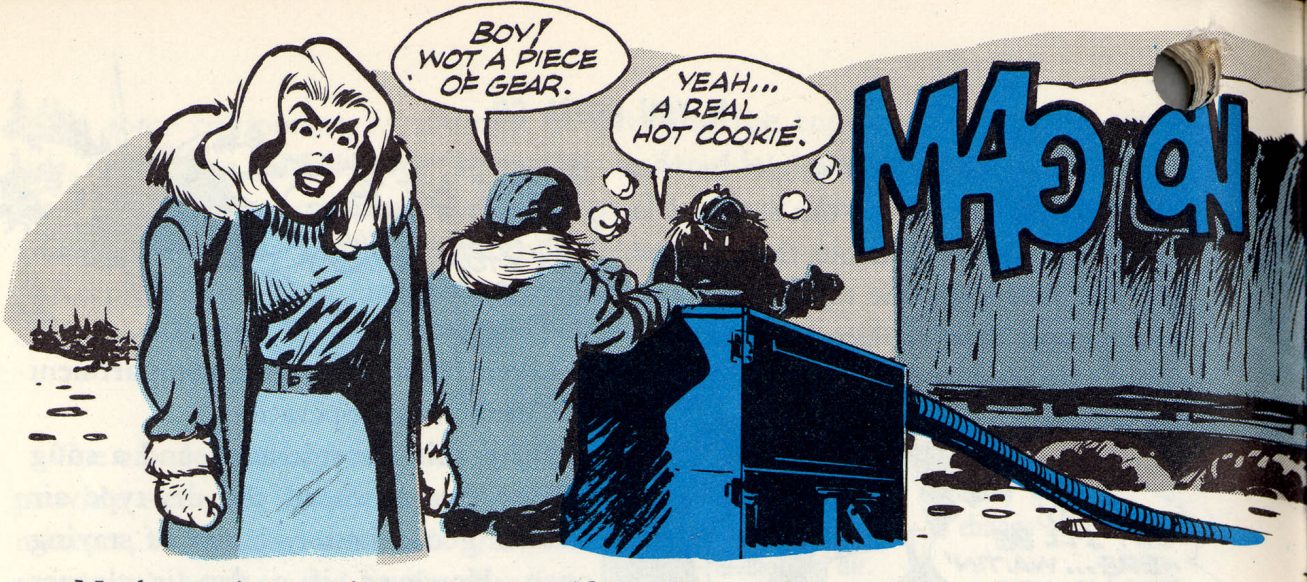


Maybe you're moving up on a cold front—or perhaps the cold front's moving up on you.

Either way, your equipment better be in top shape. And all your cold weather equipment like personnel and power-plant heaters want to be ready for action.

With your own built-in body heater and the right clothes and food, you can take the cold lotsa times when your equipment can't.

When that thin line's fading down the thermometer stem, you can crawl into a clean, dry sack and take it for quite a spell, even in snow and ice. But after your equipment's stood around a few hours, there may be trouble waking it from its winter nap . . . even if it's protected with the right antifreeze.

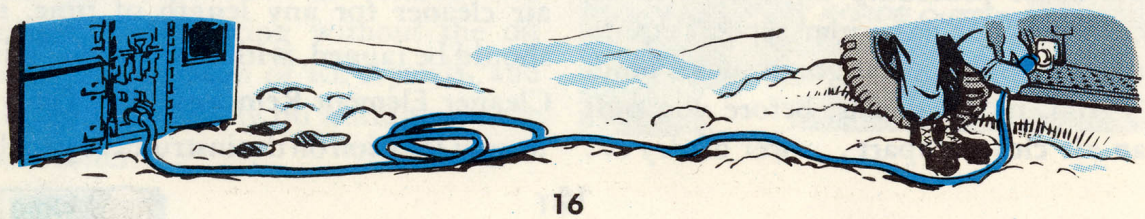
Batteries lose their punch (voltage may drop more'n half), oils get stiff and hard for gears to stir. In extreme cold, ordinary oils and greases, plus any moisture around, may freeze solid.

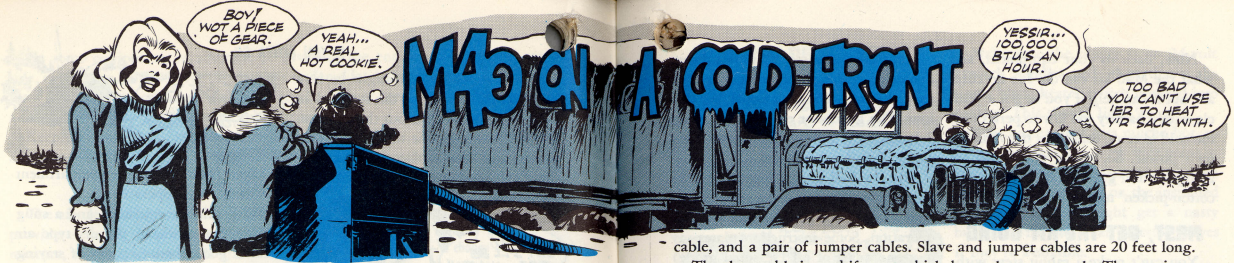
That'll be the day when it'll pay to have an M40 cold starting aid (slave) kit in your maintenance shelter, or mounted on skids or the covered body of a truck or trailer. Mounted to go, it's ready to rescue any vehicle or equipment that's clobbered with the cold.

You get the kit like it says in SB 9-16 (13 Feb 62). The rule there gives you one kit for each 25 vehicles—if the average temperature for the coldest month of the year is +5°F or lower. (Maybe it's not that cold where you are now, but a jet can get you there in a few hours.)

The M40 kit's got two major units (heat and electrical power) to help get your vehicles and other equipment into action.

One is for slave starting, and includes the set of four 4H 6-volt batteries, a generator operated by a one-cylinder air-cooled engine, a regular two-way slave





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cable, and a pair of jumper cables. Slave and jumper cables are 20 feet long.

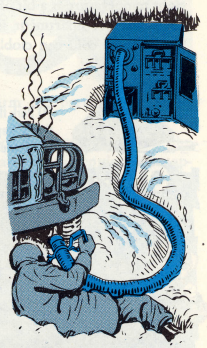
The slave cable is used if your vehicle has a slave receptacle. The two jumpers give you a direct connection to a dead vehicle's batteries if there's no slave receptacle.

The kit's slaving power output can be adjusted to 6-volt, 12-volt or 24-volt systems by lever-type switches that automatically lock out the slave cable output receptacles that are not in use. (The 24-volt system is standard for most vehicles in your stable, but it's always best to check!)

The other major unit in the kit is a heater that operates off the same set of batteries and the same fuel tank used by the generator engine.

The heater, electrically driven and gasoline fired, puts out 100,000 BTU's an hour through a 20-foot flexible metal duct. It's used to warm up the crankcase, engine components, gear cases, tracks, brakes or other parts that are iced up or that have lube or other fluids and are just too cold to operate. The heater can be used to warm the kit's own generator engine—or to warm up another kit when you've got two.

When your equipment is properly prepared and maintained, this kit gives you the heat needed to keep it in action even down to −70°F. And that's colder'n the hinges when the fire's out.

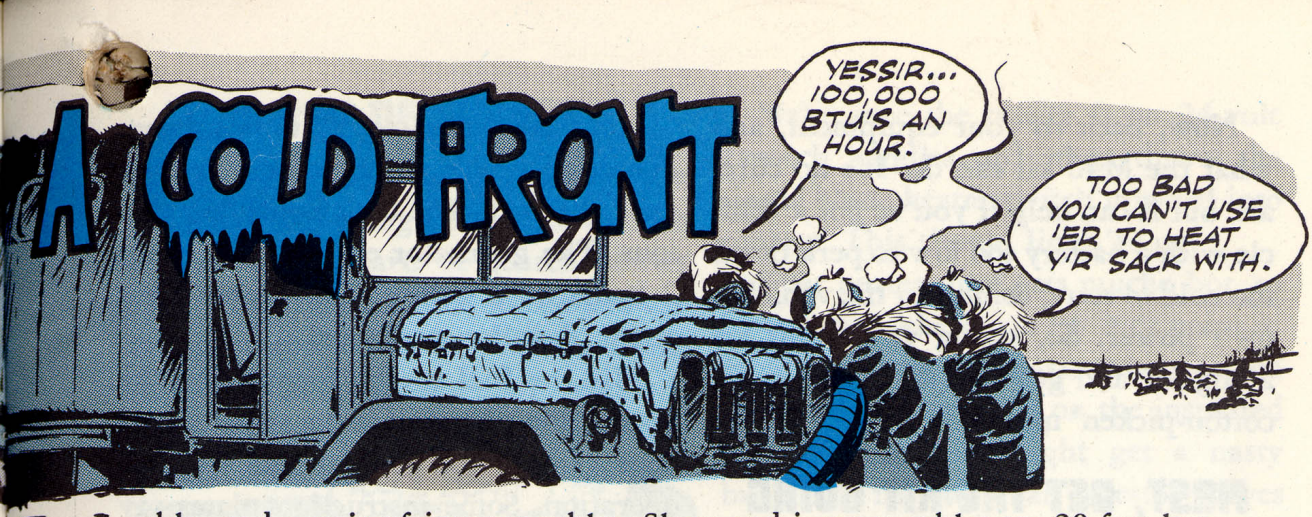


DANGER

THIS HEATER CAN BE USED TO WARM UP MOST ANYTHING **EXCEPT** PEOPLE. THAT MEANS IT'S NOT, **NOT NOT** TO BE USED TO WARM YOURSELF OR YOUR VEHICLE CREW COMPARTMENT OR CAB—IF YOU WANT TO STAY HEALTHY, THAT IS.

The reason: The hot air is contaminated with carbon monoxide—OK for heating equipment but no good for breathing.

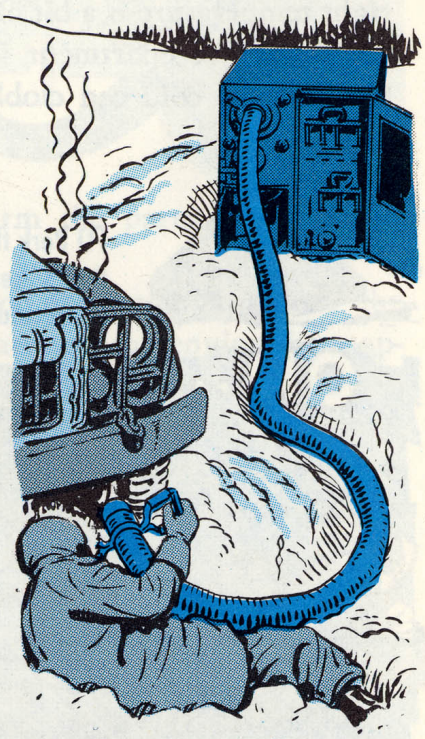
(PS) MORE



cable, and a pair of jumper cables. Slave and jumper cables are 20 feet long.

The slave cable is used if your vehicle has a slave receptacle. The two jumpers give you a direct connection to a dead vehicle's batteries if there's no slave receptacle.

The kit's slaving power output can be adjusted to 6-volt, 12-volt or 24-volt systems by lever-type switches that automatically lock out the slave cable output receptacles that are not in use. (The 24-volt system is standard for most vehicles in your stable, but it's always best to check!)



The other major unit in the kit is a heater that operates off the same set of batteries and the same fuel tank used by the generator engine.

The heater, electrically driven and gasoline fired, puts out 100,000 BTU's an hour through a 20-foot flexible metal duct. It's used to warm up the crankcase, engine components, gear cases, tracks, brakes or other parts that are iced up or that have lube or other fluids and are just too cold to operate. The heater can be used to warm the kit's own generator engine—or to warm up another kit when you've got two.

When your equipment is properly prepared and maintained, this kit gives you the heat needed to keep it in action even down to −70°F. And that's colder'n the hinges when the fire's out.

DANGER

THIS HEATER CAN BE USED TO WARM UP MOST ANYTHING EXCEPT PEOPLE. THAT MEANS IT'S NOT, NOT NOT TO BE USED TO WARM YOURSELF OR YOUR VEHICLE CREW COMPARTMENT OR CAB—IF YOU WANT TO STAY HEALTHY, THAT IS.

The reason: The hot air is contaminated with carbon monoxide—OK for heating equipment but no good for breathing.

P.S. MORE

Now, back to your equipment, and what the M40 kit can do. It's no cure-all, but it can help if you've got a vehicle with a battery too low to perk or oil too cold to start, using just the vehicle's own power. So, swing your M40 kit alongside and get with it . . . but just a cotton-picken' minute . . .

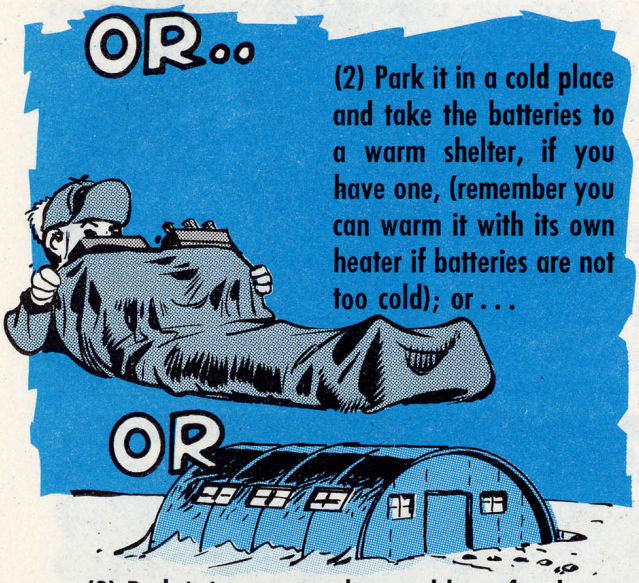
FIRST, GET THE KIT GOING

You can't make a rabbit stew without a rabbit. And to get a vehicle under way with the M40 kit, you first make sure the kit's in shape.

Natch, you keep it dry under a shelter or vehicle canvas. Keeping it at the right temperature is a bit of a problem. Its battery compartment is insulated, but extreme cold can clobber the batteries.

So, you:

(1) Park the kit in a place that's kept at medium temperature . . .

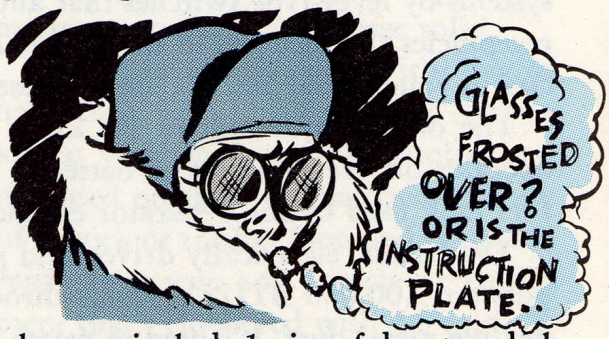


(2) Park it in a cold place and take the batteries to a warm shelter, if you have one, (remember you can warm it with its own heater if batteries are not too cold); or . . .

(3) Park it in a warm place and hope for the best. If you take it from a shelter that's too warm into extreme cold, condensation could knock it for a loop.

Keep the fuel tank full to avoid condensation inside it. Besides you may need the fuel. The tank holds 8½ gallons. The generator engine runs about 2 hours on a gallon. The heater takes about .8 gallon per hour.

Mix the fuel by the formula on the instruction plate inside the switchboard door (front) for general cold weather operation. Some instruction plates say mix one quart of oil (seasonal grade) with each 5 gallons of gas. TB Ord 390 (18 Jul 52), Para 12d(2), says use one-half pint of OE-10 oil per gallon of gas or 1 pint of OES (subzero). The TB



also says include 1 pint of denatured alcohol for each five gallons of gas. Use 90 to 100 octane gas when you can get it (it'll burn most any grade, but when you want a fire you use the best you can get).

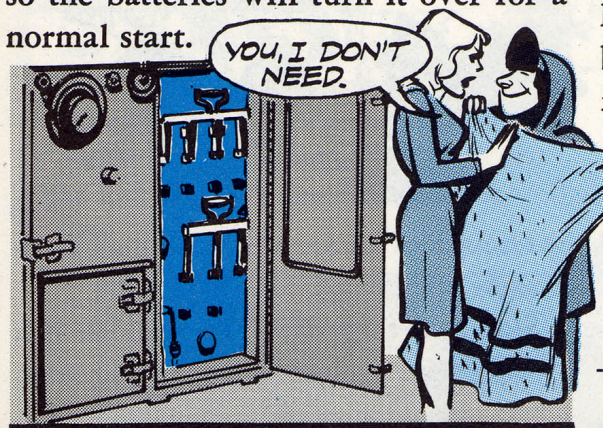
The TB formulas are likely to be especially important in extreme cold, so keep a close eye on the mixture. Too little oil and your engine won't get lubed. Too much and it'll get fouled up and choke on excess carbon.

And mix that formula **completely** before you pour it into the fuel tank.

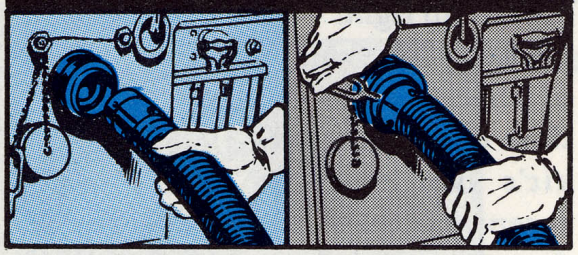
Check the electrolyte level and specific gravity in the batteries regularly. Same as with your vehicle, the kit won't go without 'em. See page 46 of this issue, about batteries.

IF YOU NEED HEAT

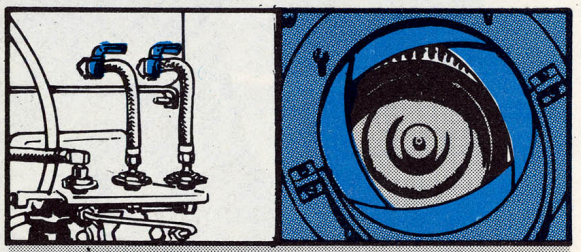
Let's say your vehicle batteries are OK except for being a bit weak. But the engine won't start. A search shows there's no other trouble, so chances are that heat applied to the crankcase and other engine components will warm it so the batteries will turn it over for a normal start.



Throw the switchboard to the 24-volt position —the only heater-starting position because of the heavy initial draw (75 amps). Leave the switches there as long as you're operating without the generator in action. With generator on, the switches can be shifted.



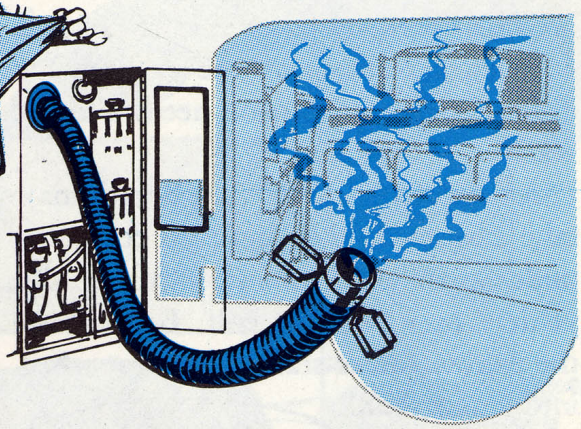
Attach the heater duct to the front outlet.



Turn ON the two fuel cocks at left side above heater fuel pump.
Open the air inlet port on lower right corner.
Adjust the camera-style shutter with a flick of the wrist (large opening for cold weather, small for colder subzero).

Make sure the power is on 24-volt (switch handles up), then throw the single blade heater switch upward into contact. This should light 'er up.

That heater duct gets mucho hot, so have a care where you lay it or point it. Hold its nozzle near parts to be warmed by keeping your mitts on the insulated handles—else you might get a nasty burn. It's best to wear asbestos gloves if they're available.



You warm the parts that need it, natch.

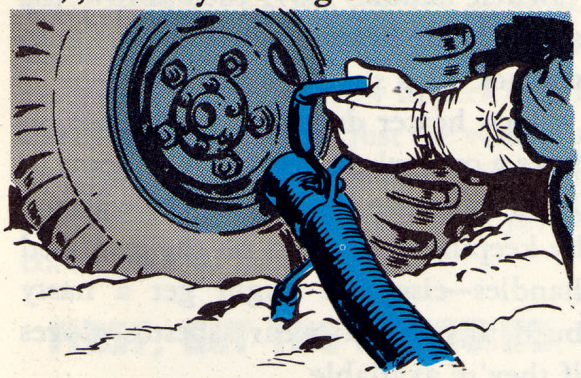
With hood down to hold hot air like a blanket around the engine, heat applied to the crankcase rises up and warms other parts. This may be enough to get the vehicle moving. In extreme cold, you may need to apply heat to components like the carburetor, generator, radiator, and gear cases.

You have to be extra careful when you point the heat at electrical or rubber components. It's best not to apply heat to any components more'n 15 minutes at a time.

Once the vehicle engine's warm enough to start, operate it at a speed fast enough (1100 to 1300 RPM) to warm it up to normal operating temperature (160-180 degrees). Check to see that all gages show normal opera-

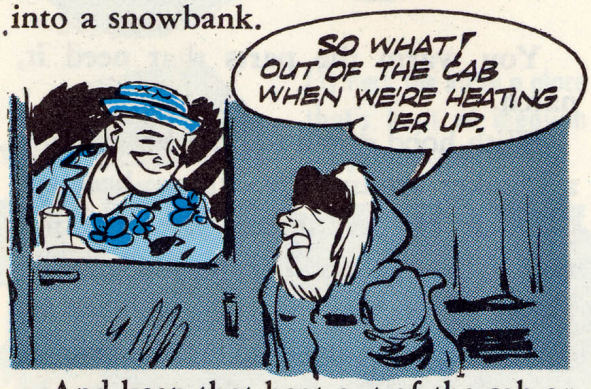
PS MORE

tion (they may need a bit of warmth, too), then try moving out.



It may be that your brakes are frozen or your tires (or tracks, if it's a tracked vehicle) are frozen to the ground. Or maybe your transmission needs a bit of warmth for shifting.

A shot of that M40's hot breath may take care of it. But don't go crawling underneath when there's a chance the vehicle may start to roll. Better stop the engine and re-start than get mashed into a snowbank.



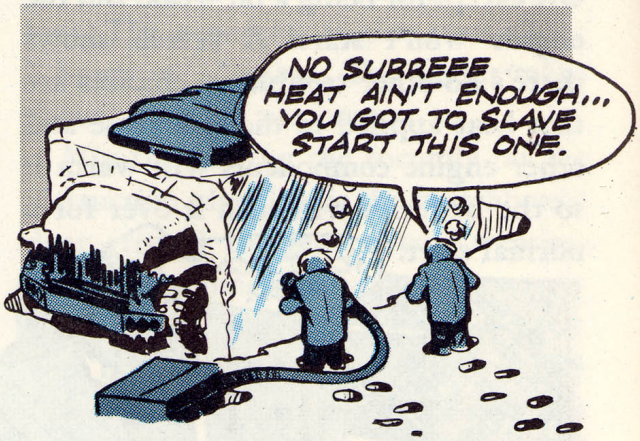
And keep that heat out of the cab or crew compartment or any place where troops will ride. If instruments and controls need heat, get at 'em the best you can from the engine compartment and underneath.

Better be a bit chilly than get a slight case of asphixiation followed by rigor mortis.

To stop the heater, cut off the fuel at the tank. Let 'er run a coupla minutes, then cut off the main heater switch.

WHEN HEAT IS NOT ENOUGH

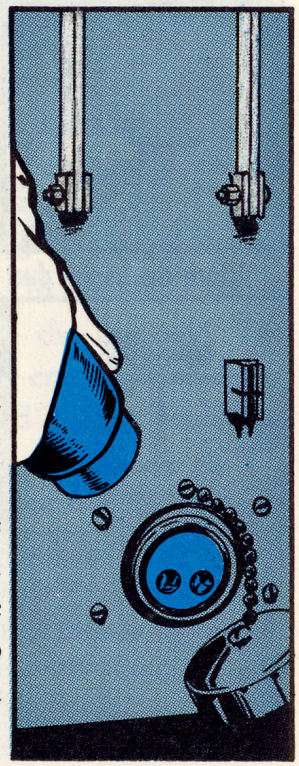
When vehicle batteries are low and the vehicle's cold-soaked, heat may not



be enough of an answer. You may have to slave start it.

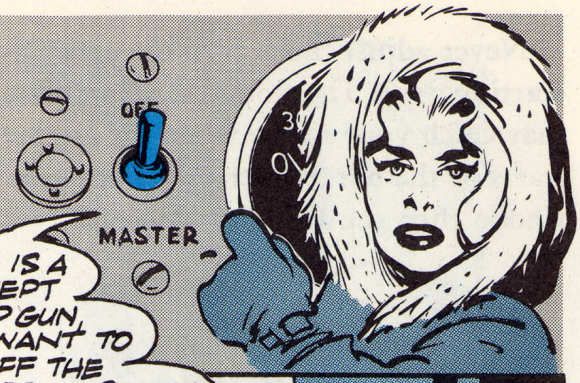
Slave starting with the M40 kit is a lot like with another vehicle—but with a few special quirks of its own.

If you're using the slave cable or slave receptacle for the first time, it's a good idea to test 'em with a test lamp like it says on pages 10-12 of PS 85, to see that positive and negative wires are hooked up right.

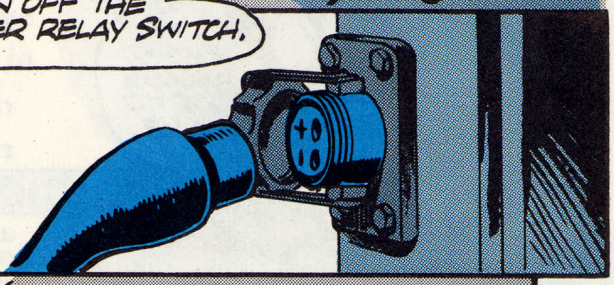


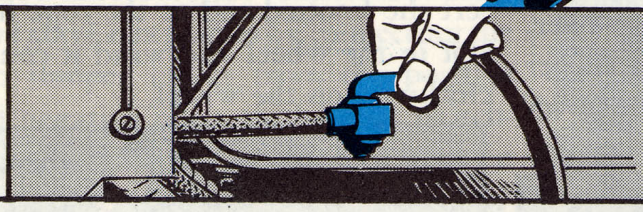
Once you're sure of this, plug the slave cable into the kit's switchboard receptacle. Select the one to match the dead vehicle's electrical system. For standard tactical vehicles it's 24-volts —but check it. Connecting posts on the cable and holes in the receptacle are slightly off center so it's unlikely you can insert 'em wrong.

For extreme cold, check to see if you've got the latest approved cables described in Change 1 (20 Jan 54) to TB Ord 390 for subzero weather. They should have 3-in white bands near the ends.



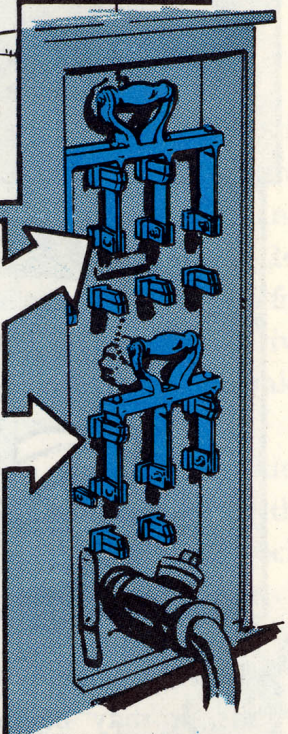
Now connect the slave cable to the dead vehicle's slave receptacle. Remember, low battery power is a problem in extreme cold, so get set to start the M40's generator engine.

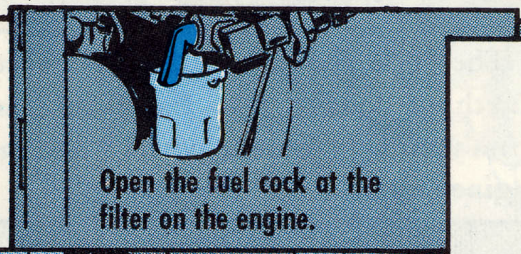




Open fuel cock on the left side of the kit (at the tank).

Open the engine access door at front (use heater to warm engine and battery if needed). Use tarps to hold the heat.



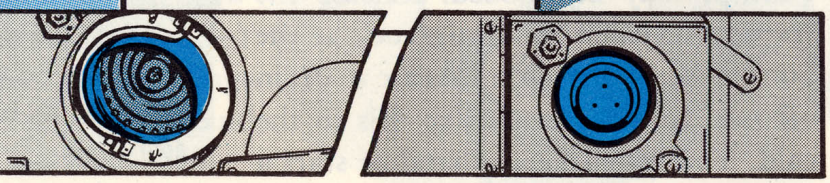


Open the fuel cock at the filter on the engine.

Choke the carburetor as needed (choke is open with lever back against stop pin.)

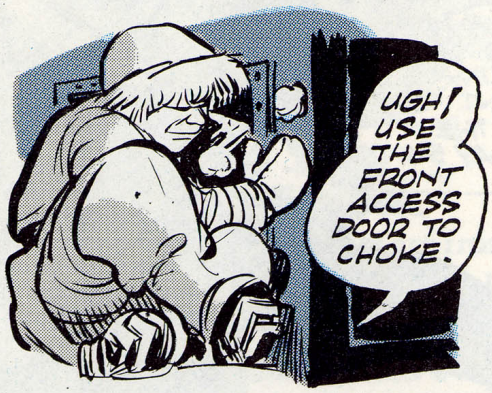
Place both power switches in 24-volt (upward) position. (They'd be there already if you used the heater.)

Open the air intake port and the exhaust port on right side.

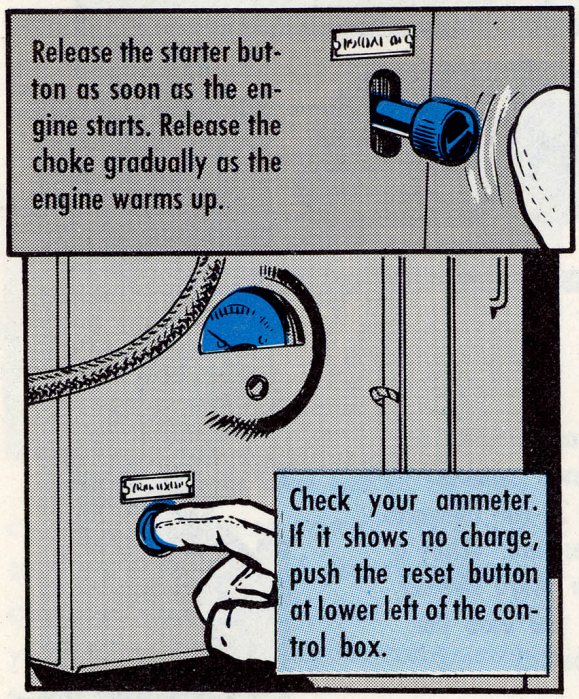


P.S. MORE

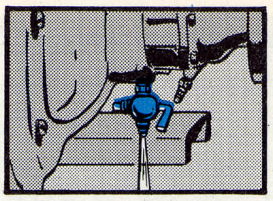
Never adjust choke thru the manual-starting door. The slotted starting plate may catch your sleeve when the engine starts or the hot muffler may burn you. Choke thru the front access door.



Since you're using 24-volt power, you can start with the electric starter button up front. You can't use this with the switchboard set for 6 or 12 volts.



If the engine won't start in 30 seconds, it may be flooded. Release the starter and open the drain cock at the bottom of the engine crankcase to drain off raw fuel. Careful with this in the cold. You may freeze a hand or start a

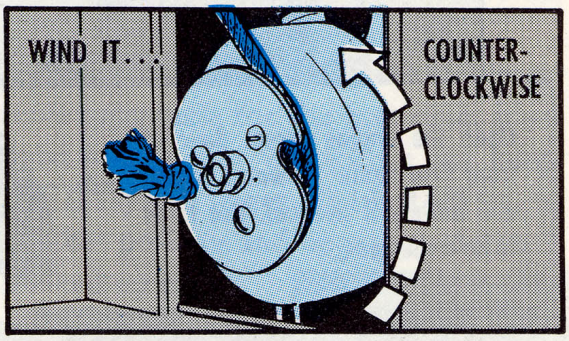


fire. Might be best to catch it with a rag and remove it to a safe place.

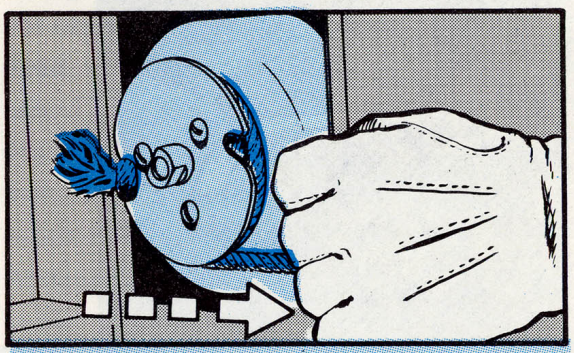
The engine can be hand-started in 6, 12 or 24-volt positions. For this, you follow the same steps as for electric starting up to the point where you push the starter button.

Instead of using this button, you open the hand-starting access door on the right.

Take the starting rope from its stowage spot inside the front of the kit. Insert the knotted end of the rope in the slot in the wheel and wind it counter-clockwise on the wheel.



The rope should be 2½ to 3 feet. Anything longer may hang up and wind your arm into the wheel when the engine starts.

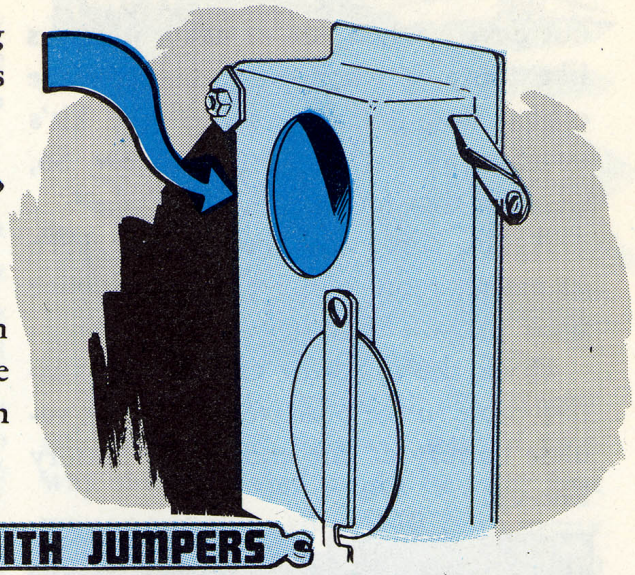


To start, pull the rope firmly and quickly straight toward you (away from the wheel). Adjust the choke as needed thru the front door.

When you close the hand-starting door, make sure the exhaust port stays open.

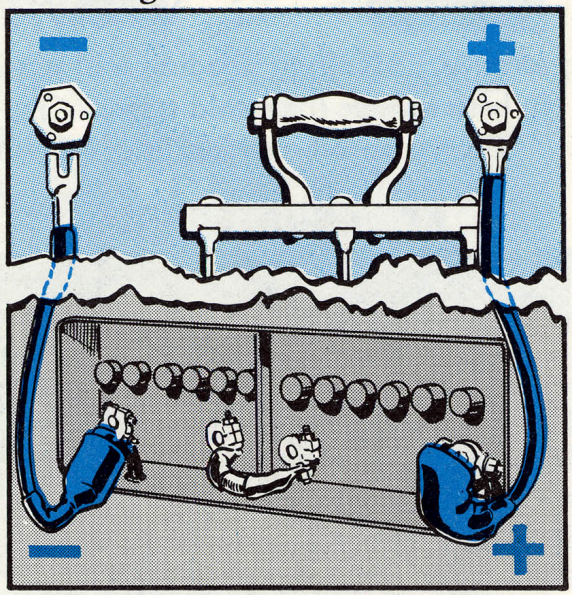
But, remember, you never operate the M40 kit in a maintenance shelter or any inclosed area unless it's well ventilated.

Once your generator's charging with engine operating smoothly, use the starter in the vehicle you're slaving in the normal way.



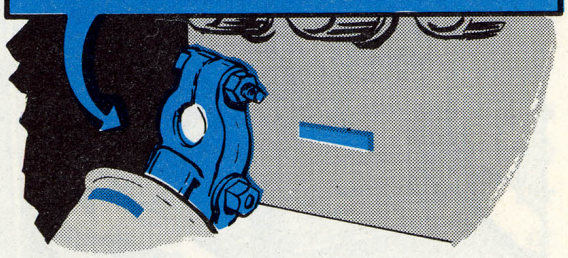
SLAVING WITH JUMPERS

You can slave start vehicles that don't have slave receptacles by connecting the two jumper cables from the positive and negative posts on the kit's switchboard to positive and negative posts on the vehicle batteries. Make sure positive is connected to positive and negative to negative.



Cable ends usually are marked with a plus (+) for positive, but the negative may be marked with a minus (−) or it may be blank. The same markings usually are on the kit's power posts and on the batteries.

To avoid arcing, hook up the **grounded** side last. (Most vehicles have a negative ground, but some have positive grounds—watch it).



The kit's jumpers have slotted ends that attach to the power posts. Slip the slots under the handwheel nuts and tighten. When switches are in the 24-volt position, you may sweat a bit fitting the positive cable to the positive post, especially with gloves on. But take it easy—it'll go.

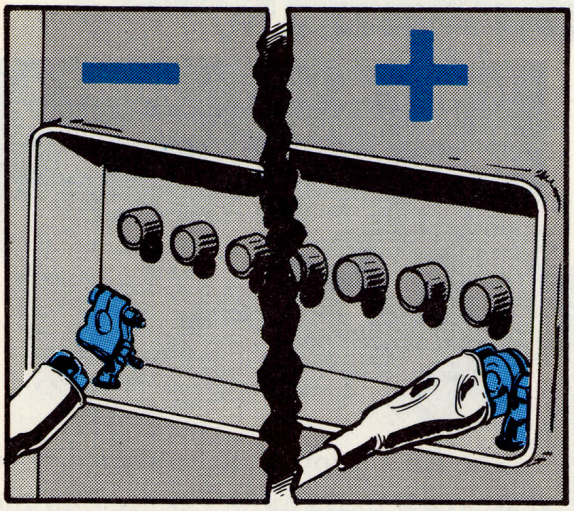
Double check to see that the kit's switches are set for the voltage of the vehicle you're slaving. There's no lock-

PS MORE

out device when you're using jumpers like there is when you use the slave cable. You get the voltage the kit's switches are set on — high or low. So, see to it that it's just right.

Again, if it's a tracked vehicle, turn its master relay switch OFF (and leave it off till you disconnect the cables).

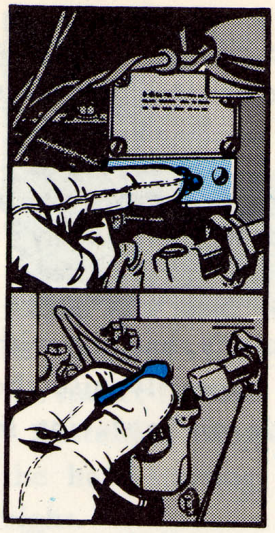
Hook the alligator clip of the positive cable to the positive post of the vehicle battery at one end of the battery line-up.



Then, and only then, clip the negative cable to the negative post of the battery farthest from the point where the positive cable is connected.

You're set now to try for a start with the vehicle starter. But it might be a good idea to re-check all connections (positive-to-positive, negative-to-negative) and to make sure switches are set for the right voltage. This is no place for mistakes.

After starting, disconnect the cables in reverse, STARTING with the negative clip at the battery (if it's negative grounded). Disconnect before turning on the tracked vehicle master relay switch.



To stop the engine, ground the magneto by holding the switch (on the panel just above the fuel filter) firmly in the OFF position till the engine stops.

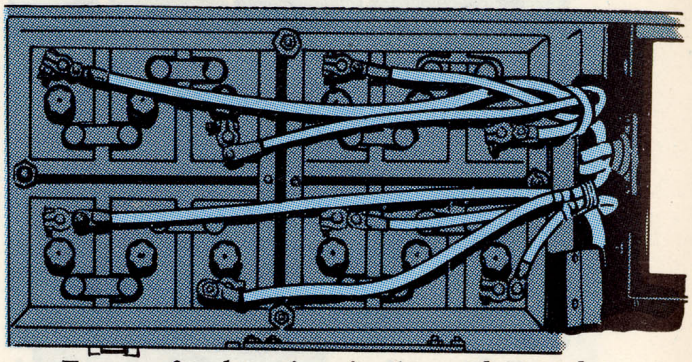
Shut off the fuel cocks at the tank and at the filter.

If it's likely to get extremely cold before a re-start, open the fuel cocks after a few minutes, leave the magneto grounding switch and the choke OFF, then push the starting button a few

seconds. This slight flooding will put it in better shape for a cold start.

Then turn off the fuel cocks again.

KIT MAINTENANCE



Except for keeping it clean, dry and warm enough to operate, the M40 kit's fairly easy to maintain.

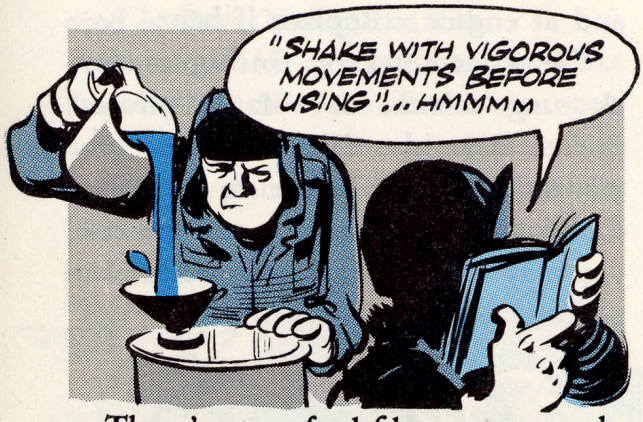
Batteries, o'course, should be kept clean with connections firm—and properly hooked up.

See that you're using the right type of batteries and check the electrolyte level and specific gravity like it says in TB Ord 390 and TM 9-6140-200-15.

If batteries freeze, never do a quick-thaw job. Thaw 'em gradually at a heated shelter. Never add water to a cold battery, and after you add it to a warm one, run the generator for a spell (about an hour) while it's still warm.

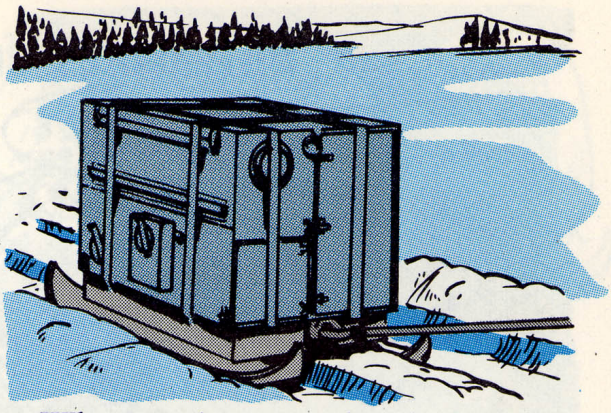
When batteries must be taken out to charge 'em, warm 'em to at least 35°F before you start to charge.

Fuel is a critical problem. Keep it clean before it goes into the tank and mix well before pouring. The kit's engine, like other air-cooled two-cycle engines, is vapor pressure lubed by the oil mixed in the fuel. But an excess of oil builds up carbon that may foul the engine plug and plug the exhaust ports. So don't overdo a good thing.



There're two fuel filters—one on the heater and one near the engine carburetor—that should be checked often.

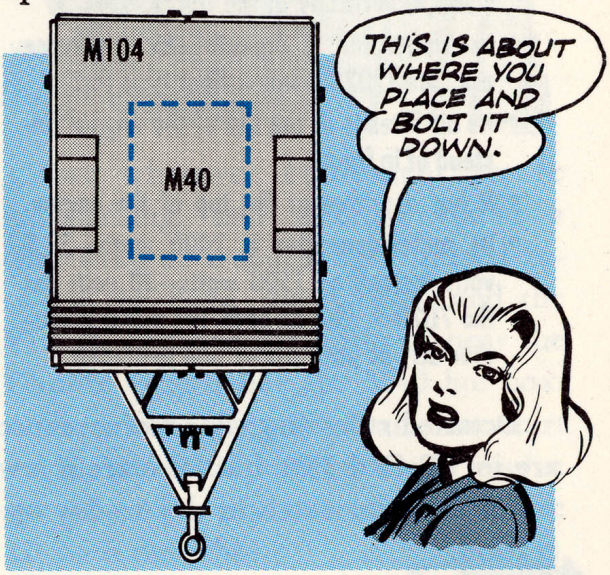
If you get water in the gas, your best bet's to drain and refill. It's likely to turn to ice and plug the system in minutes once the kit cools in extreme cold. But, if you must go with what you've got, a little denatured alky can help to tide you over.



When you're operating in extreme cold with snow, a heavy pair of two-way skis or a sled might be your best way to transport your M40. It's a pretty hefty load, weighing around 800 pounds.

Most people haul it on a trailer (say the M104) or on the back of a ¾-ton or 2½-ton cargo truck. To hold it steady and keep it in place for ready use, it should be bolted down. (It comes with 4 9/16-in bolt holes in the bottom.)

The kit has to be positioned far enough from the sides of the trailer or truck bed so you can get at both sides and front panels. Also the top. Panels, ports and doors on all sides except bottom and back have to be opened for operation and maintenance.



END

DIFFERENCES BETWEEN MODELS

Like TB Ord 390 tells you, there are two models of this M40 kit—both wear FSN 2540-570-1354. But about the only real differences between 'em are found in the engine generator unit.

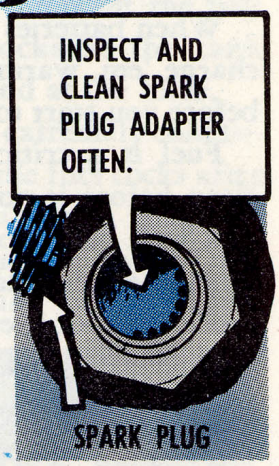
The M40 Kit used for this article has the Model 7D28-9 engine generator unit.

The other has a Model HRU-28 engine generator unit, and here are the major ways that it differs from the Model 7D28-9.

- **It's mounted on coil springs to reduce shock (instead of rubber feet) and has an auxiliary 1-gal gas tank mounted at its base.**
- **The voltage regulator is mounted on the generator (on the 7D28-9 it's mounted separately).**
- **The control box is located horizontally at the base of the unit on the right side (instead of vertically at the front).**
- **Its carburetor is operated by crankcase pressure (7D28-9 has a float type carb).**
- **Its air filter is at the top of the engine (instead of in front).**
- **It has a primer at the top of the engine.**
- **Its motor-generator is 2000 watts—28.5 volts instead of 1500 watts—30 volts for the 7D28-9. (But on both, the motor generator acts as both starter and generator.)**

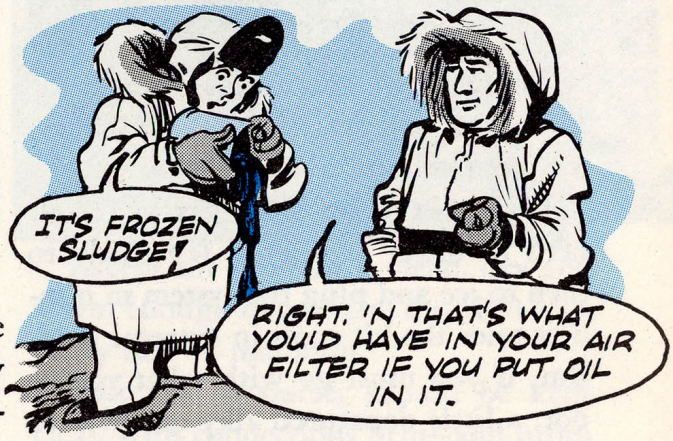
Detailed rules on major maintenance are in TB Ord 390, but here are a few you'd need to watch in day-to-day operation.

The spark plug must be kept clean with gap adjusted to 0.025. Spark plug adapter has 11 holes that may become plugged with carbon (especially with too much oil in the fuel). Inspect and clean often.

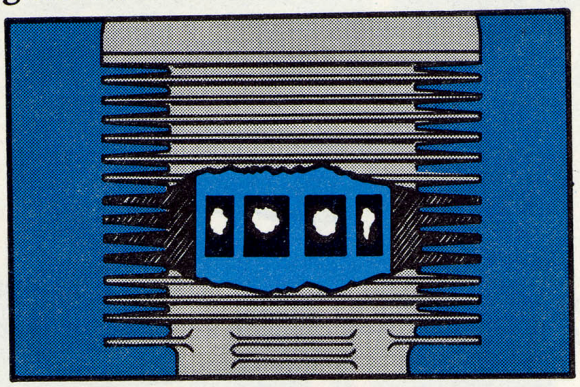


Clean fuel filters often (at heater and at engine). Replace if bent.

Clean air filter by rinsing in dry-cleaning solvent or volatile mineral spirits. Dip clean filter in engine lube oil and drip-dry before re-installing. Careful, though, 'cause in extreme cold you may have to leave it without oil to prevent stoppage.



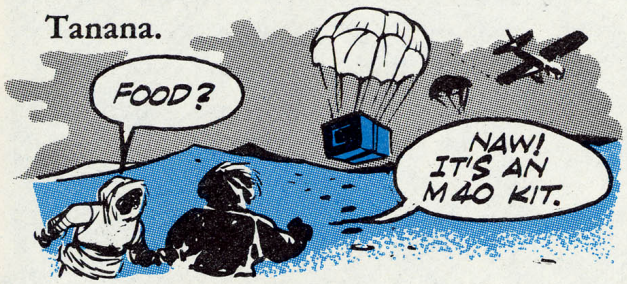
Check the engine exhaust ports for excess carbon every now and then. There should never be more than 1/16-in of carbon at the top of the ports, but it can build up as much as 1/4-in at bottom without damage. O'course, if you've opened it up to inspect, clean it, regardless.



Adjust your carburetor when it's needed like it says in Para 21c of TB Ord 390. A slightly richer mixture may be needed in extreme cold.

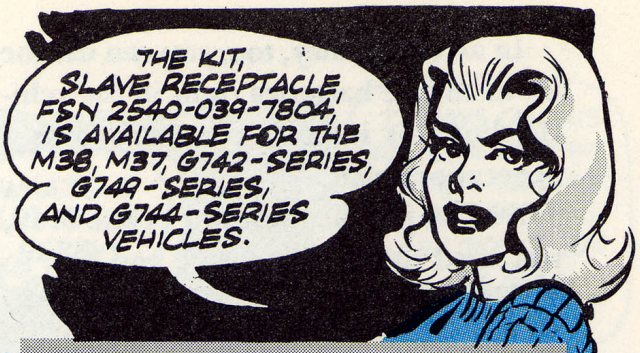
General trouble-shooting info is covered in Para 21m of the TB.

The M40 kit is available any place described in SB 9-16. But it's a 'specially handy outfit for a cheechako who's suddenly plunked down somewhere between the aurora borealis and the Tanana.



But to make best use of the kit, some of your vehicles may need a bit of facelifting.

Like SB 9-16 says, a lot of your vehicles may need engine primer kits and slave receptacle kits, but check first to see if they're already installed.

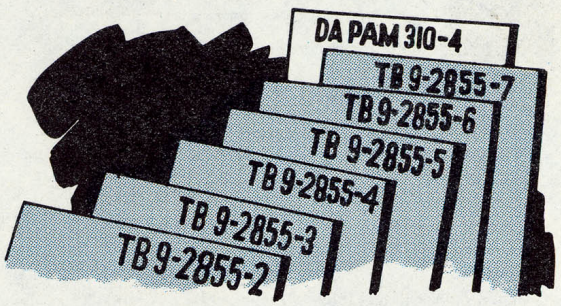


For the Kit, engine primer, here are the FSN's:

M38	2540-039-7805
M37	2910-039-7806
G742's	2910-039-7807
G749's	2540-039-7808
G744's	2540-039-7809

For the M38A1's you get the slave receptacle along with the engine heater kit, FSN 2540-039-7785, and you get the engine primer, FSN 2540-039-7784, along with the personnel heater kit.

General info on winterization of vehicles is covered in TB's of the 9-2855-series. See DA Pam 310-4 for the one that covers your vehicle.



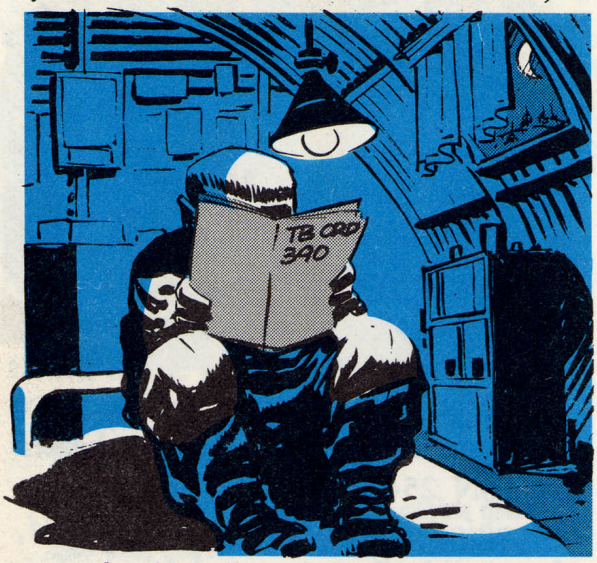
But whatever equipment you're maintaining, and whether you're a cheechako or a sourdough camped between the Bear, the Klootch and the Yukon, or along the Imjin or near the Danube, you'll like the M40 hot box.

In an emergency, you can slave start the kit with a 24-volt vehicle. If you've got two kits, you can even slave one kit with the other.

PS MORE

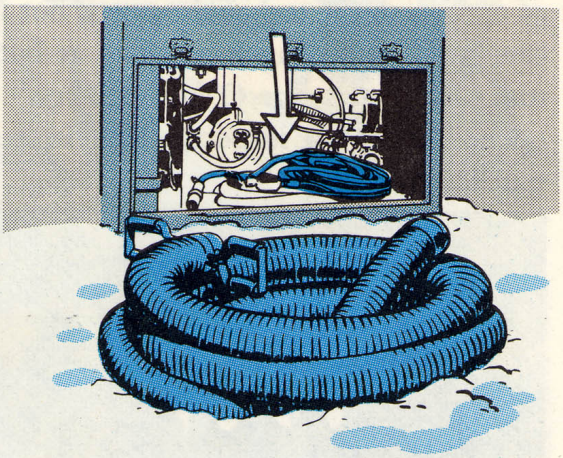
In an emergency, too, you can use the kit to charge batteries right in the vehicle, but this is not recommended as a general practice.

And to get the most out of the M40, you need to know it inside and out, so



spend a bit of time thumbing thru TB Ord 390 (18 Jul 52) and Change 1 (20 Jan 54). A copy's supposed to go along with each kit.

Another thing: Keep the cables, operating tools and spare spark plugs stowed inside the kit like the TB says.



There's no stowage space inside for the 20-ft heater duct, so keep this parked alongside the kit wherever it goes.

If you drop it in snow or ice while hot, it may bury itself. Besides, it'll freeze when it cools and you may have to chop it out.

And take care of those batteries. They're the heart of the whole deal.

A good steer

Here's another URGENT modification for your Walters Model MF fire truck. It goes by MWO 5-4210-202-35/2 and covers the modification of the steering system. Sound off for your support people to lend a hand.

Pin stop

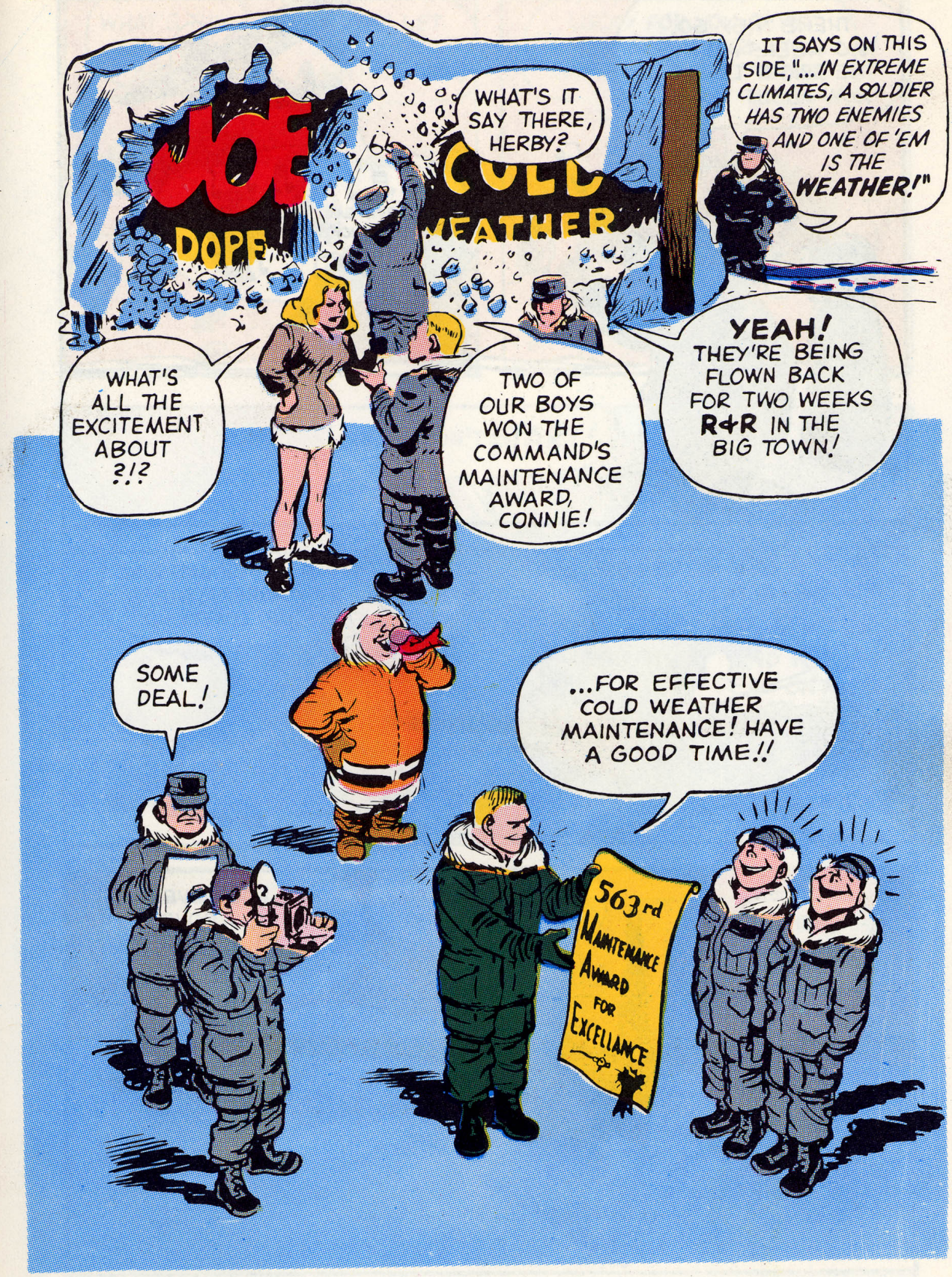
You M60 machine gunners had better check with your armorer to make sure MWO 9-1005-224-20/1 (14 May 62), has been applied to your weapon. It's the MWO that installs a pin in the M60's cover assembly to act as a positive stop for the latch lever—so the lever won't overturn and damage the spring.

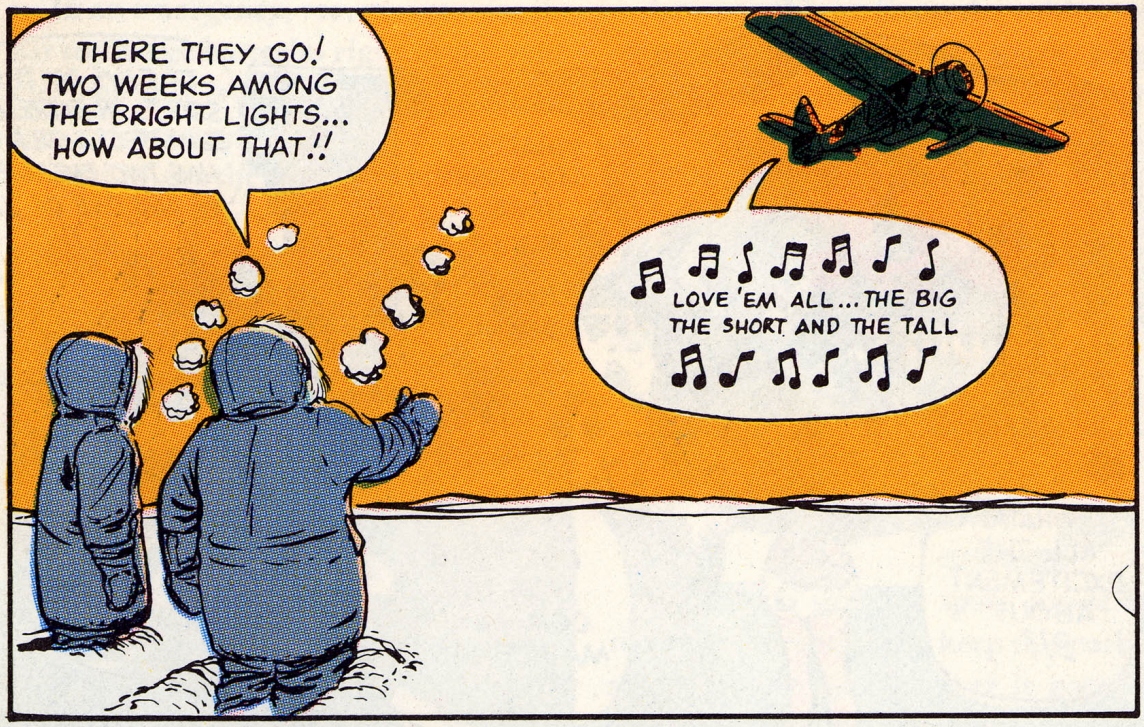
Nike-hercules missilemen:

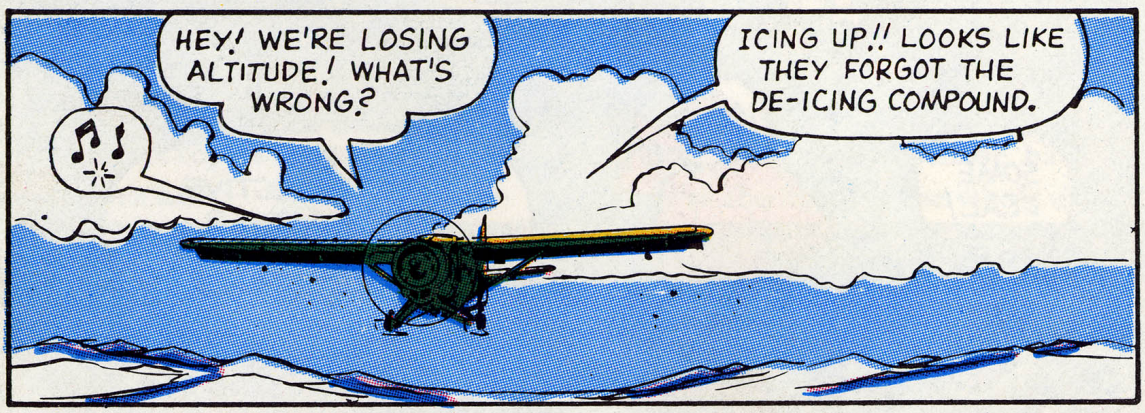
Take a good look at SM 9-4-4935-A31 (28 Jun 62). It's the one that superseded SM 9-4-5180-A08 and its Change 1. You'll see in the new SM that Flashlight, FSN 6230-519-2109, has been replaced by Flashlight, FSN 6230-117-0928. The big difference is that the new flashlight has a 90-degree bend in it.

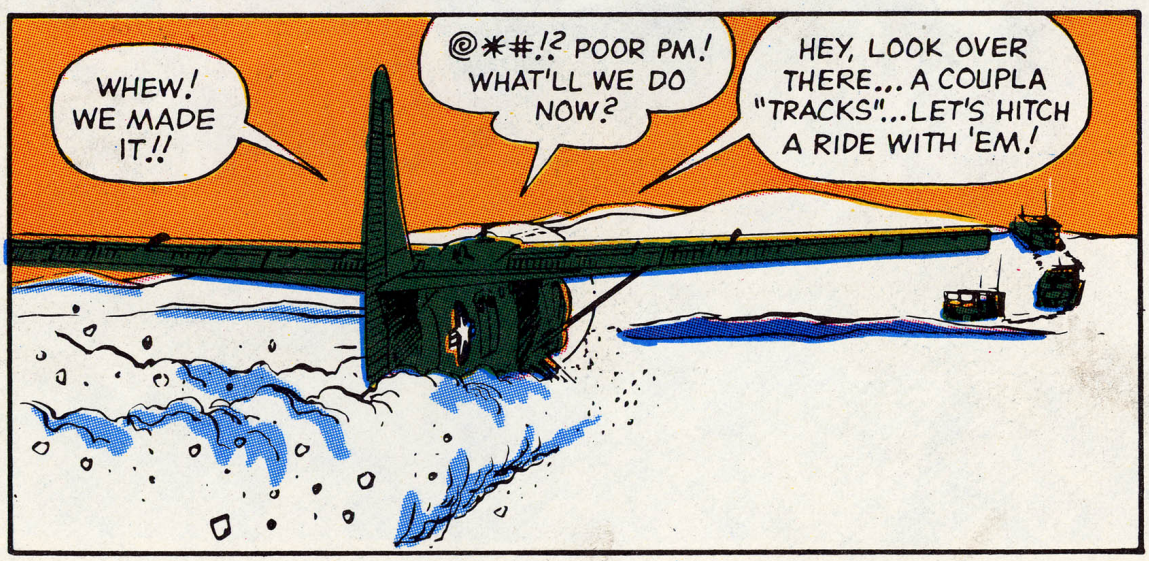
Engineer Licenses

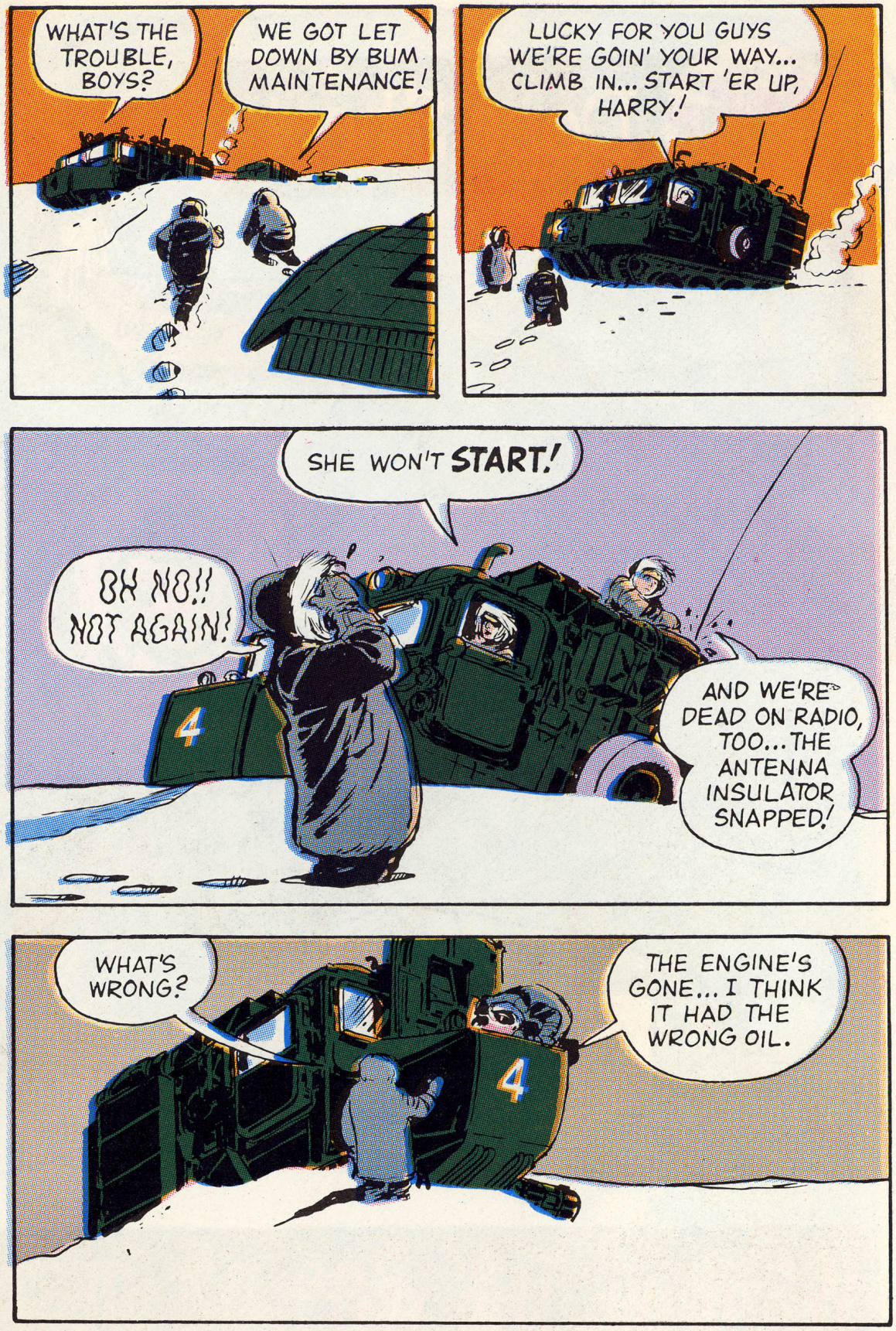
Need info on licensing operators of Engineer equipment? Take a gander at AR 600-58 (21 Nov 61) and TB 5-505-1 (Nov 61) which cover the requirements, testing and procedures to follow when qualifying operators for your Engineer rigs—including generators and high pressure air compressors.


JOE
DOPE
WHAT'S IT SAY THERE, HERBY?
COLD WEATHER
IT SAYS ON THIS SIDE,"... IN EXTREME CLIMATES, A SOLDIER HAS TWO ENEMIES AND ONE OF 'EM IS THE WEATHER!"
WHAT'S ALL THE EXCITEMENT ABOUT ?!?
TWO OF OUR BOYS WON THE COMMAND'S MAINTENANCE AWARD, CONNIE!
YEAH! THEY'RE BEING FLOWN BACK FOR TWO WEEKS R&R IN THE BIG TOWN!
SOME DEAL!
...FOR EFFECTIVE COLD WEATHER MAINTENANCE! HAVE A GOOD TIME!!
563rd MAINTENANCE AWARD FOR EXCELLANCE


THERE THEY GO! TWO WEEKS AMONG THE BRIGHT LIGHTS... HOW ABOUT THAT!!
LOVE 'EM ALL... THE BIG THE SHORT AND THE TALL

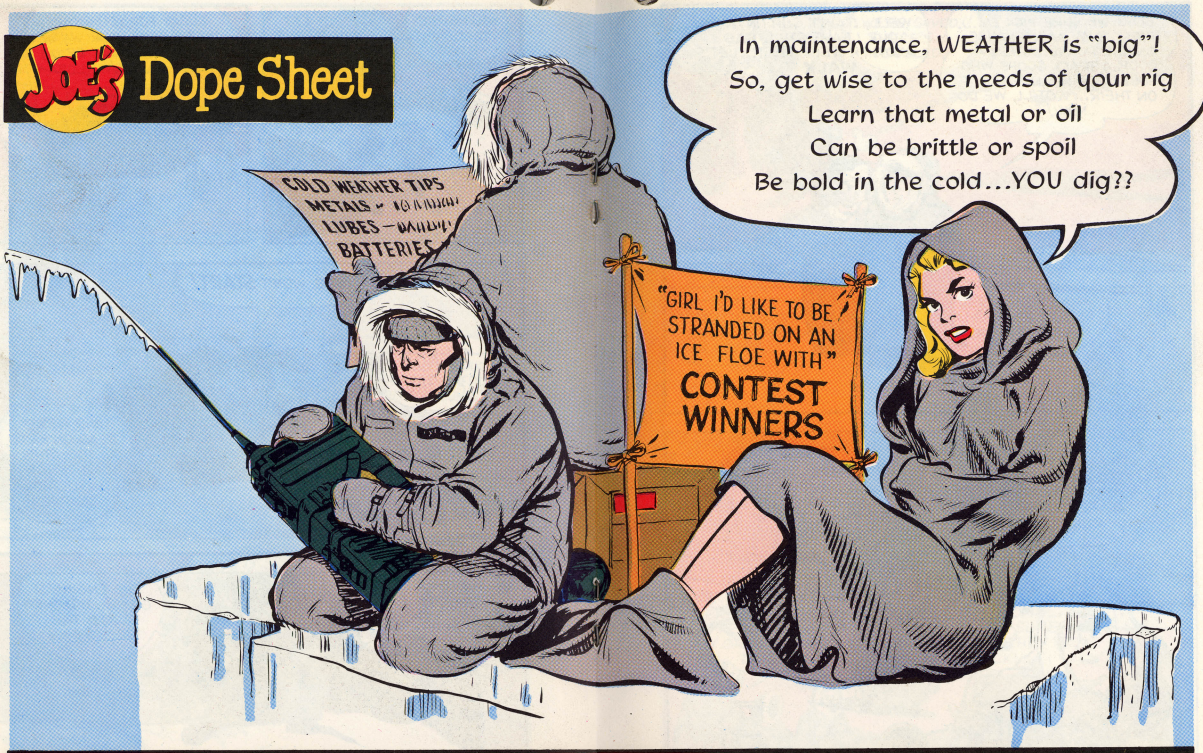

HEY! WE'RE LOSING ALTITUDE! WHAT'S WRONG?
ICING UP!! LOOKS LIKE THEY FORGOT THE DE-ICING COMPOUND.


WHEW! WE MADE IT!!
@*#!? POOR PM! WHAT'LL WE DO NOW?
HEY, LOOK OVER THERE... A COUPLA "TRACKS"... LET'S HITCH A RIDE WITH 'EM!


WHAT'S THE TROUBLE, BOYS?
WE GOT LET DOWN BY BUM MAINTENANCE!
LUCKY FOR YOU GUYS WE'RE GOIN' YOUR WAY... CLIMB IN... START 'ER UP, HARRY!
SHE WON'T START!
OH NO!! NOT AGAIN!
AND WE'RE DEAD ON RADIO, TOO... THE ANTENNA INSULATOR SNAPPED!
WHAT'S WRONG?
THE ENGINE'S GONE... I THINK IT HAD THE WRONG OIL.

WE HAVE THE WORLD'S BEST EQ

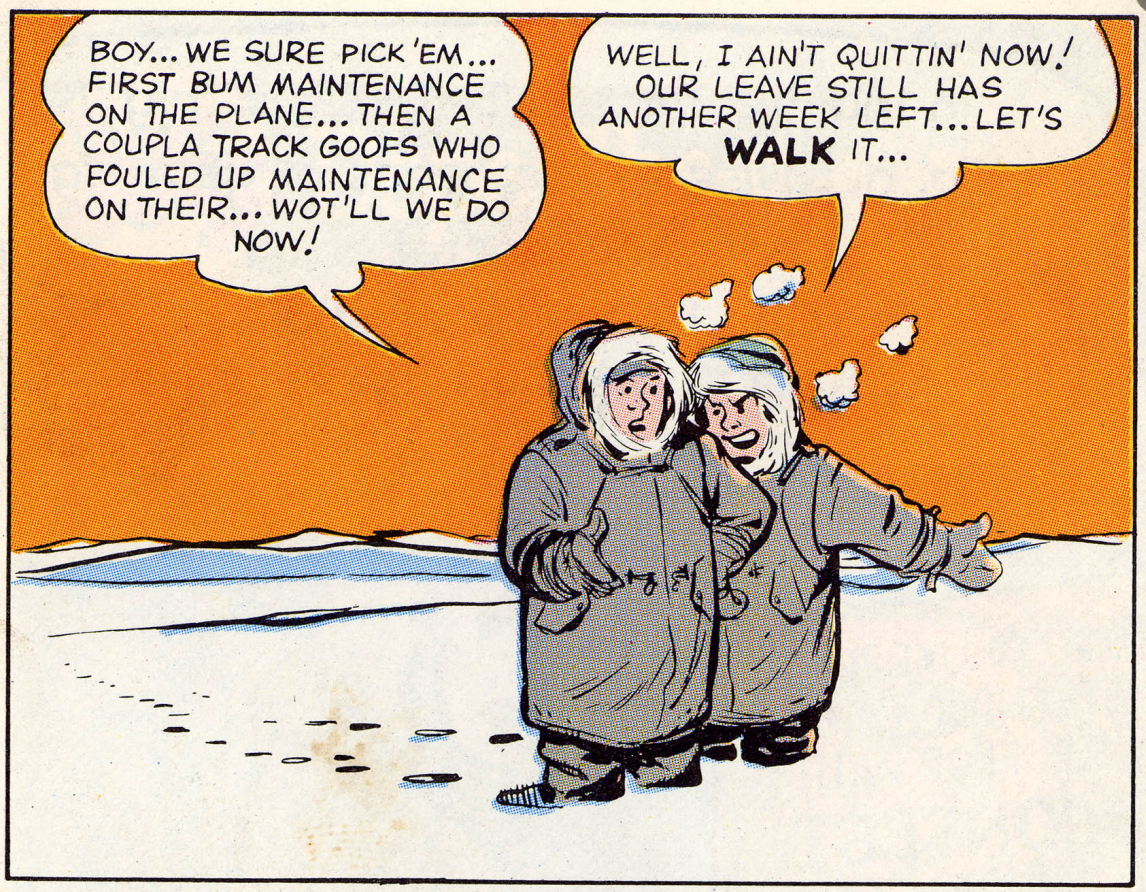
IF YOU WANT TO DISPLAY THIS CENTERPIECE ON YOUR BU

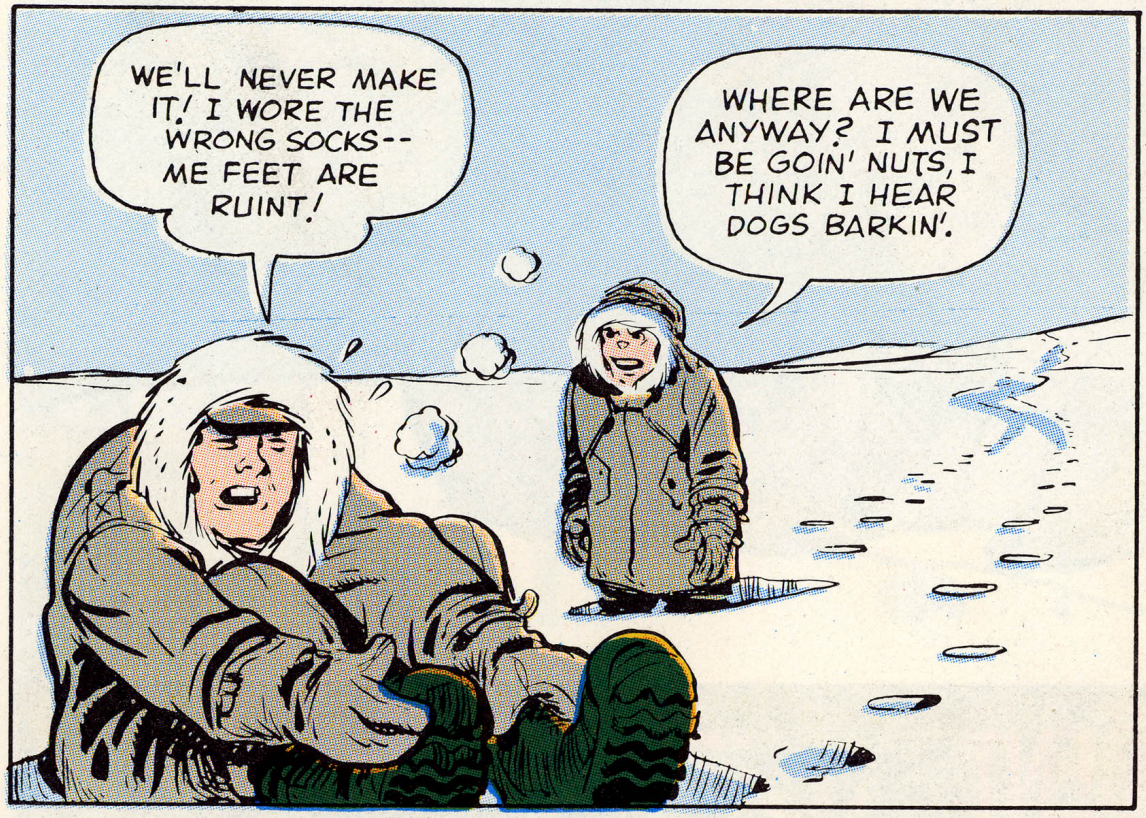


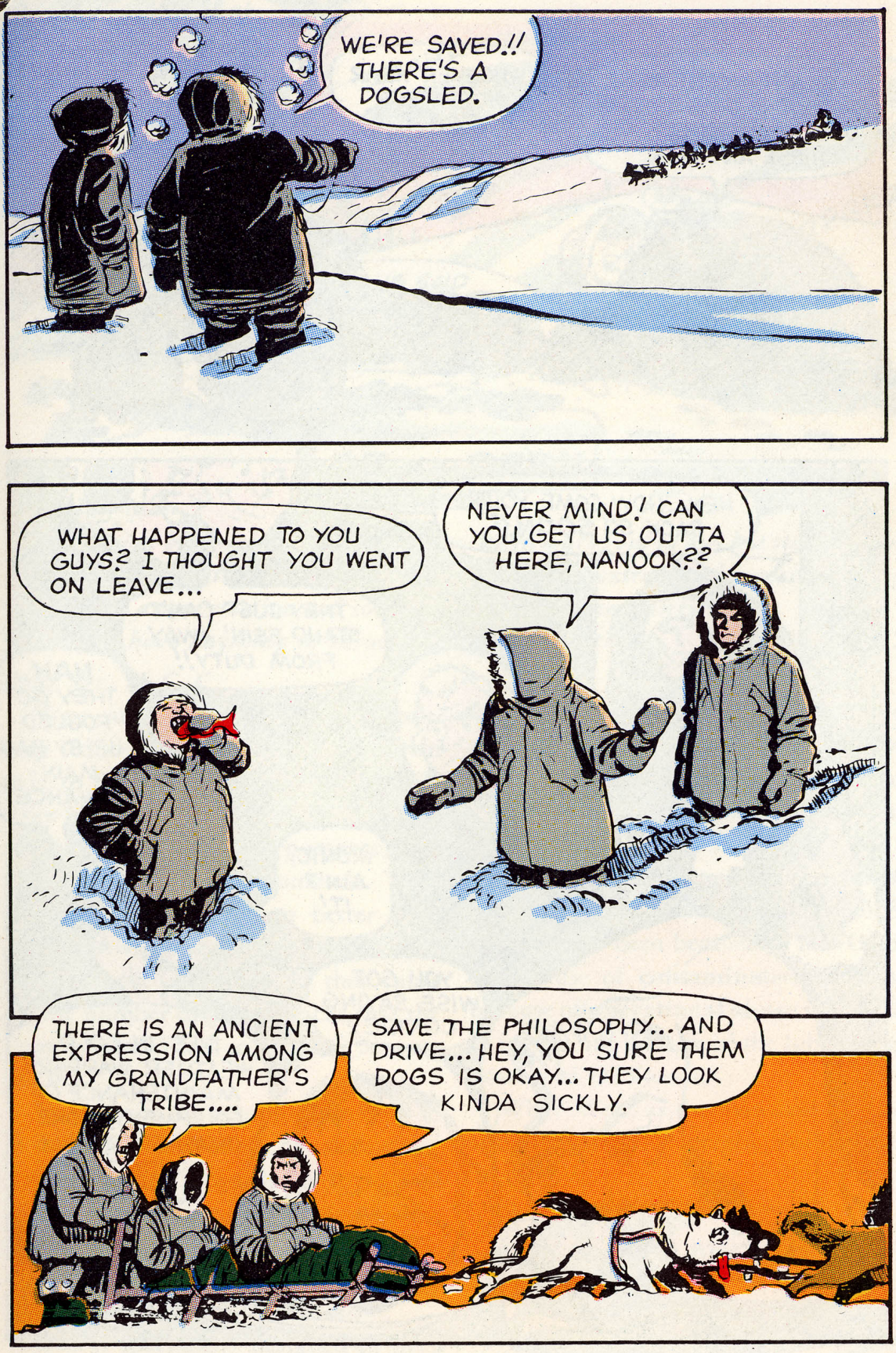
IF YOU WANT TO DISPLAY THIS CENTERPIECE ON YOUR BULLETIN BOARD, OPEN STAPLES, LIFT IT OUT AND PIN IT UP.

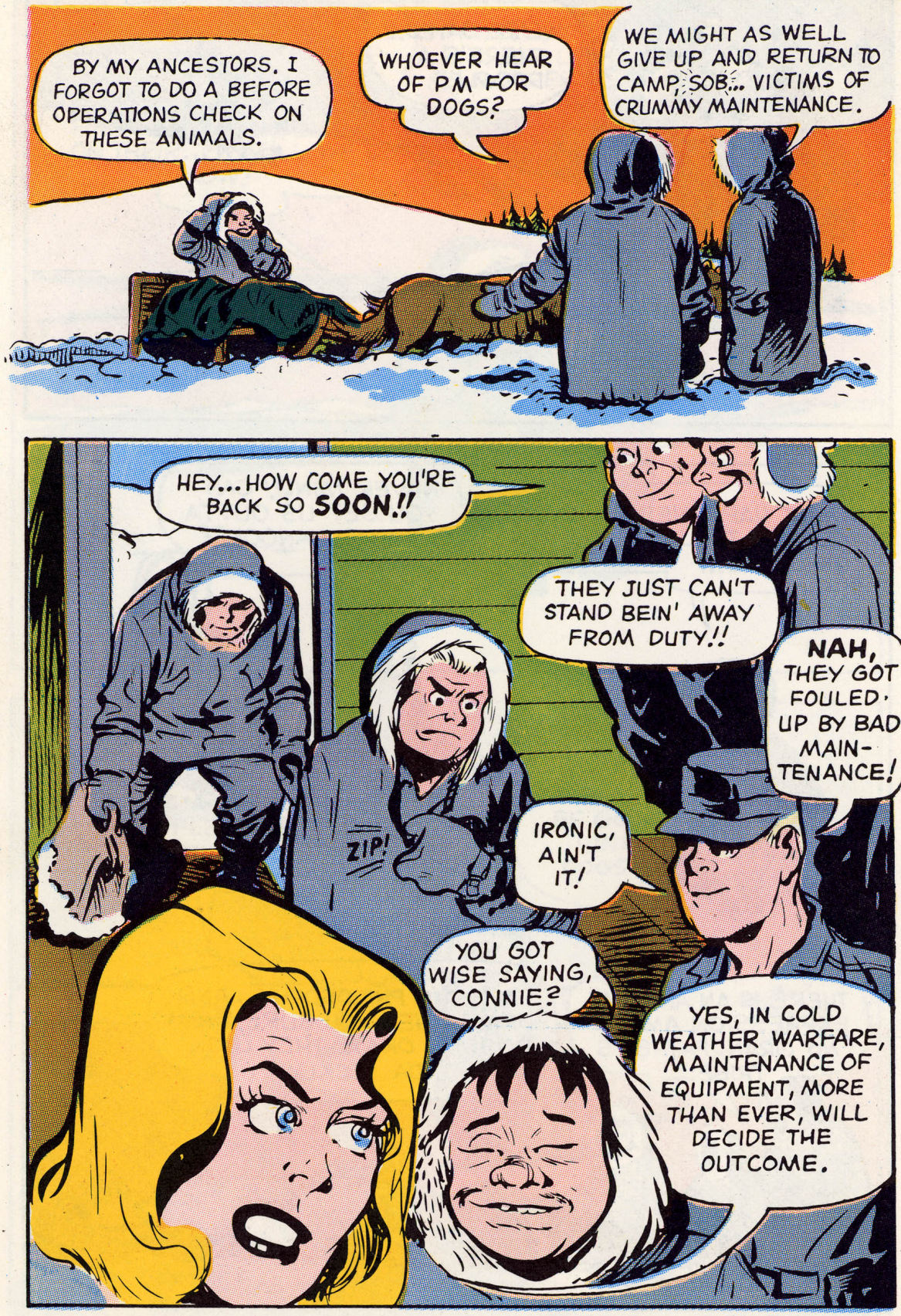
UIPMENT ...Take care of it

LLETIN BOARD, OPEN STAPLES, LIFT IT OUT AND PIN IT UP.


BOY... WE SURE PICK 'EM... FIRST BUM MAINTENANCE ON THE PLANE... THEN A COUPLA TRACK GOOFS WHO FOULED UP MAINTENANCE ON THEIR... WOT'LL WE DO NOW!
WELL, I AIN'T QUITTIN' NOW! OUR LEAVE STILL HAS ANOTHER WEEK LEFT... LET'S **WALK** IT...


WE'LL NEVER MAKE IT! I WORE THE WRONG SOCKS-- ME FEET ARE RUINT!
WHERE ARE WE ANYWAY? I MUST BE GOIN' NUTS, I THINK I HEAR DOGS BARKIN'.


WE'RE SAVED!! THERE'S A DOGSLED.
WHAT HAPPENED TO YOU GUYS? I THOUGHT YOU WENT ON LEAVE...
NEVER MIND! CAN YOU GET US OUTTA HERE, NANOOK??
THERE IS AN ANCIENT EXPRESSION AMONG MY GRANDFATHER'S TRIBE....
SAVE THE PHILOSOPHY... AND DRIVE... HEY, YOU SURE THEM DOGS IS OKAY... THEY LOOK KINDA SICKLY.


BY MY ANCESTORS. I FORGOT TO DO A BEFORE OPERATIONS CHECK ON THESE ANIMALS.
WHOEVER HEAR OF PM FOR DOGS?
WE MIGHT AS WELL GIVE UP AND RETURN TO CAMP, SOB... VICTIMS OF CRUMMY MAINTENANCE.
HEY... HOW COME YOU'RE BACK SO SOON!!
THEY JUST CAN'T STAND BEIN' AWAY FROM DUTY!!
NAH, THEY GOT FOULED UP BY BAD MAINTENANCE!
ZIP!
IRONIC, AIN'T IT!
YOU GOT WISE SAYING, CONNIE?
YES, IN COLD WEATHER WARFARE, MAINTENANCE OF EQUIPMENT, MORE THAN EVER, WILL DECIDE THE OUTCOME.

Dear Half-Mast,

The second-best way to start a real knockdown dragout in any hot stove league is to just mention the subject of crankcase lubes for extreme cold weather. Drop "OES" into a conversation and some troops treat it like a dirty word.

Do you have anything to throw into the pot on it? *SFC N. C. C.*

Dear Sgt. N. C. C.,

You can bet your fur-lined sock-trap I do—and I'll quietly move down here to the end, out of the way, while I say it.

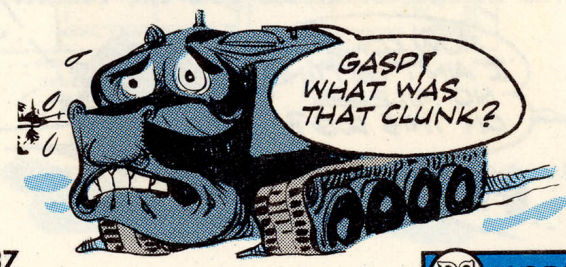
I've heard the same arguments from many a coffee-break commando. They claim that OE holds up better than OES, that starting isn't too much more trouble with OE, and then they rattle off the number of power-packs that the "umpty-ninth" had to replace "because of OES."

To begin at the beginning, why OES in the first place? Well, the slide-rule/drawing-board boys have it figured that at least 90 per cent or more of the engine damage done by starting in extreme cold weather will happen **in the first 10 seconds of operation.**

OES is specifically designed to sleep there all night at 65-below and then snap to and perform that critical lube chore in those terrible 10 seconds. (At −65°F, OES is fluid. OE is solid at −20°F.)

No power-pack ever burned up or seized or threw a rod because of OES. It may have been because of **low OES,** or because of **contaminated OES,** or because of **operational abuse** with OES in it—but not because of the lubricating powers of OES alone.

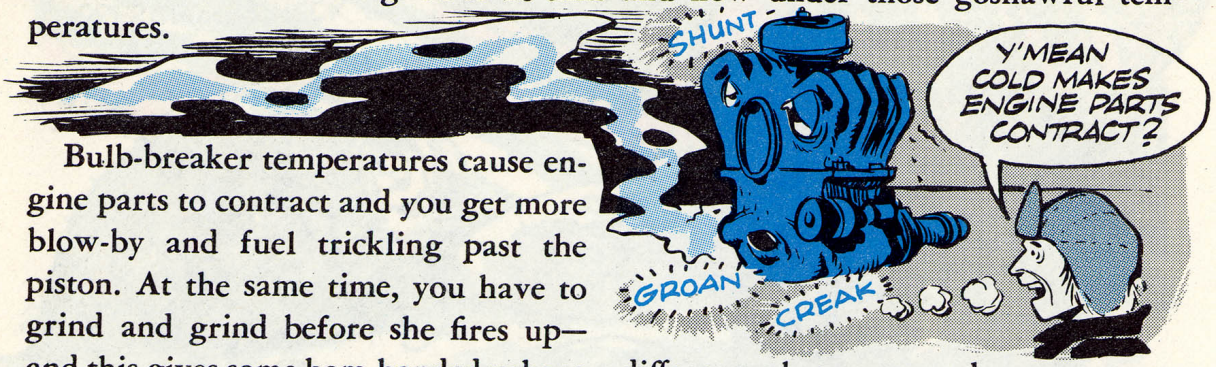
Why? Well, as the man said, it's the situation and the terrain. Follow me!



P.S. MORE

CONTAMINATION-DILUTION

The same weather conditions that tell you to go to OES in the first place also set the stage for some fantastic handicaps for any crankcase lube—only more so for OES because it's designed to be thin and flow under those goshawful temperatures.



Bulb-breaker temperatures cause engine parts to contract and you get more blow-by and fuel trickling past the piston. At the same time, you have to grind and grind before she fires up—and this gives some ham-handed yahoos an urge to over-prime—all of which gives you more raw fuel sneaking down to sabotage whatever you've got in the crankcase.

And, as if that's not enough, extreme differences between crankcase temperatures and cold outside temperatures set the stage for moisture condensation—especially at shutdown—that adds to the dilution of your lube and robs its slicking powers.

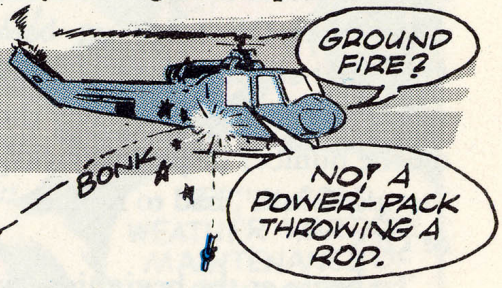
DISSIPATION

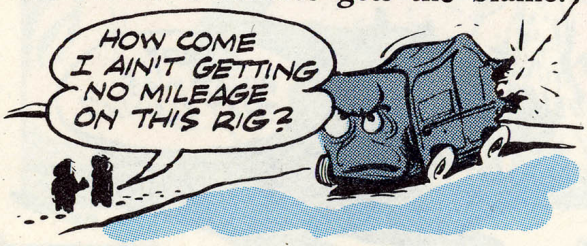
In the engine—not in town—that's what happens when your lube disappears into thin air—and at yea-below, that air seems really thin. The same conditions that give you more fuel in the crankcase also let more of your oil pass the piston into the firing chamber and burn off.

And while all this is going on, you're doing more idling and more low-gear pulling than you've ever done before—all adding to your engine temperature and lubrication problems.

BELIEVE ME, SAM!

When a power-pack burns up or seizes or throws a rod into the next county, the damage is instantaneous, dramatic, and is usually blamed on lubrication—or lack of it. So, whatever was in the crankcase gets the blame.





On the other hand, the gut-tearing raw-rubbed damage that grates your engine's entrails during a cold start with a thicker lube will be sneaky and quiet—and might not show up until later when it's torn down after a shorter-than-usual work life.

WHAT TO DO

Follow your LO. It's the law, and not only is that safer, it's a little more sure, too.

Pull that dipstick—every hour, or more often if your experience with your goat tells you to. It's easier to pull a dipstick than it is to change a pack with gloves on and snow blowing in your face. And carry enough oil with you so's you can do something about it when she reads low.

Use your nose. Keep a sharp sniffer out for fuel contamination in your crankcase by smelling the dipstick. Drain and refill if you even suspect it.

Use your eyes and fingers. Moisture (condensation) dilution of crankcase lube is hard to detect unless it's really bad. Suspect it all the time in extra cold weather. A sure check, if you have time and suspect it's bad, is to draw a sample and let it stand in a clear glass container—the water and oil will show you a separation.

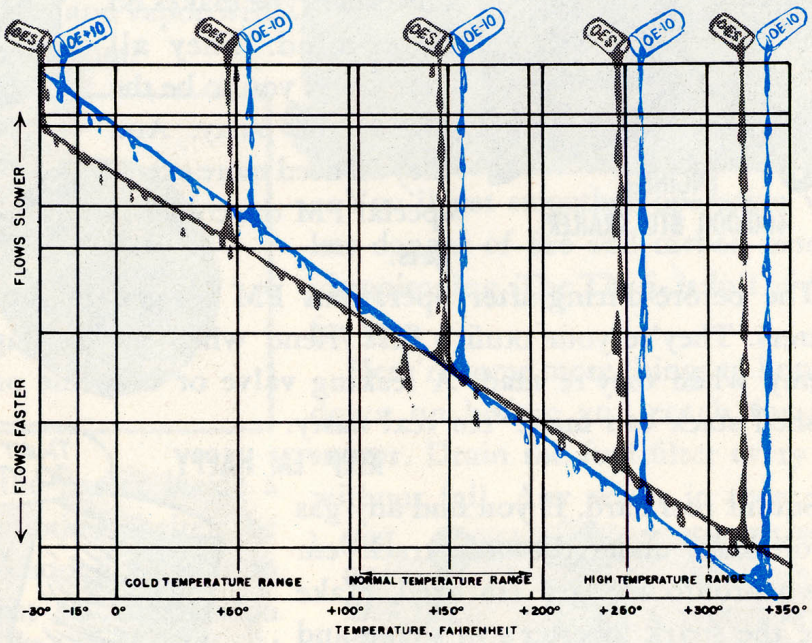
Use your head. Remember that with a lot of idling or low-gear dragging, the hours an engine is run can be more important than miles.

To sum up—if you had to, or wanted to prove the point, you could run an engine with OES in Texas in the summer if . . . if you kept the level up, if it wasn't contaminated, and if it wasn't diluted. The same thing goes—only double—where OES is really called for.

Half-Mast

WHO'D BELIEVE IT!

Here's a chart that some laboratory boys whomped up on the viscosity of OES and OE-10. In plain language, it shows how the two of 'em flow under the same conditions.

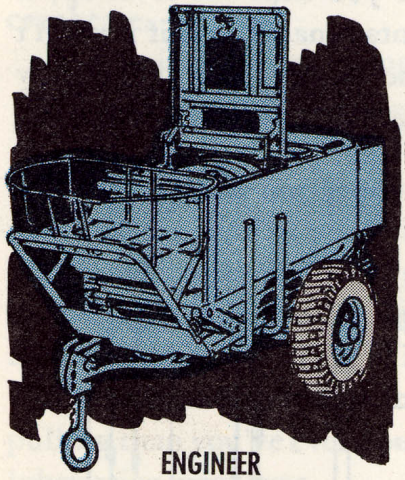


You'll see that OES flows much easier than OE-10 at cold starting temperatures . . . and yet at normal engine operating temperature it's almost the same as OE-10.

And who'da thunk it? At overheating temperatures, OE-10 actually **thins out faster than OES does!** 'Nuff said?

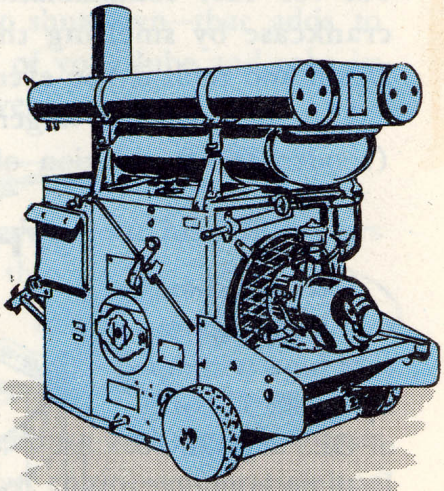
THE HAIL OF THE

Heat is life in the land of the deep freeze and yon Herman-Nelson is likely to be top-kick in your equipment pool. When Hoimie works, 'most everything works, but when Hoimie shirks . . . shucks!



ENGINEER
400,000 BTU TRAILER

Now, whether you have the Quartermaster 250,000-BTU pushcart type or the Engineer 400,000-BTU trailer—or skid-mounted type or any other type makes no never-mind. They all depend on you to be the life of the party. And they all need more extra-special PM the colder it gets.

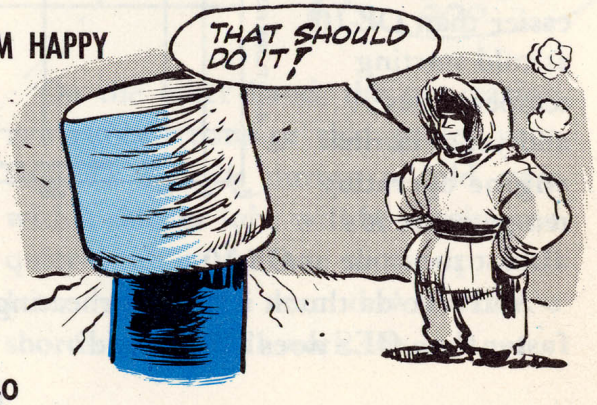


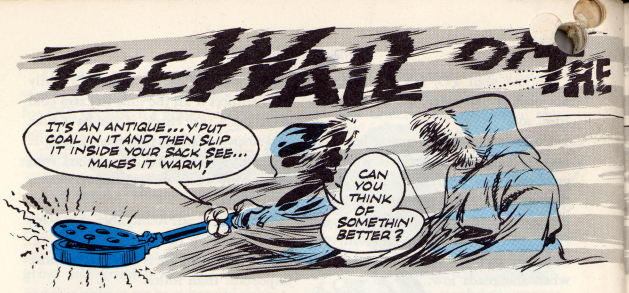
QUARTERMASTER
250,000 BTU TRAILER

The before-during-after operations PM bit gets mighty important on these critters. They're your otufit's best friend when they're happy, but your worst enemy when they're mad. A leaking valve or fuel line or a busted duct or a stashed stack can make 'em real nasty.

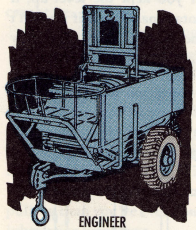
KEEP 'EM HAPPY

Squint real hard. If you find any gas or oil leaks under the unit, track 'em down pronto and get 'em fixed. Make sure the spark arrester's in shape and in place. See that no carbon or snow or ice's collected there. Keeping a cap on the stack when it's not used will help.



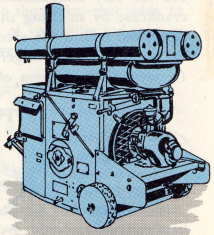


Heat is life in the land of the deep freeze and yon Herman-Nelson is likely to be top-kick in your equipment pool. When Hoimie works, 'most everything works, but when Hoimie shirks . . . shucks!



ENGINEER
400,000 BTU TRAILER

Now, whether you have the Quartermaster 250,000-BTU pushcart type or the Engineer 400,000-BTU trailer—or skid-mounted type or any other type makes no never-mind. They all depend on you to be the life of the party. And they all need more extra-special PM the colder it gets.

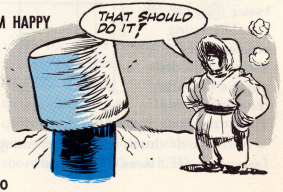


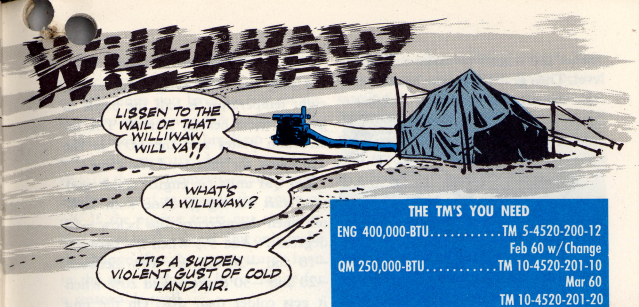
QUARTERMASTER
250,000 BTU TRAILER

The before-during-after operations PM bit gets mighty important on these critters. They're your otufit's best friend when they're happy, but your worst enemy when they're mad. A leaking valve or fuel line or a busted duct or a stashed stack can make 'em real nasty.

KEEP 'EM HAPPY

Squint real hard. If you find any gas or oil leaks under the unit, track 'em down pronto and get 'em fixed. Make sure the spark arrester's in shape and in place. See that no carbon or snow or ice's collected there. Keeping a cap on the stack when it's not used will help.

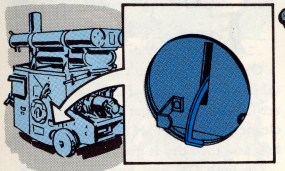




THE TM'S YOU NEED

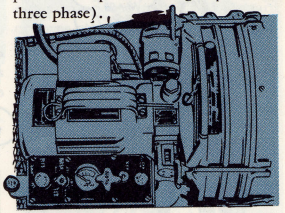
ENG 400,000-BTU.....TM 5-4520-200-12
Feb 60 w/ Change
QM 250,000-BTU.....TM 10-4520-201-10
Mar 60
TM 10-4520-201-20

On the 250,000-BTU jobs, keep a sharp eye on the safety trip lever. Make sure it works before you start the engine and see that it keeps working while the engine's running. Make sure first that it'll operate with the engine off. Look for bends in the lever and make sure it won't hit against the metering and fuel shutoff or damper pull rods. 'Cause if it won't work right, fuel and vapor will build up in there and—boom!



If you're using the heater inside a maintenance tent or other shelter, be mighty sure there's enough ventilation and that the exhaust stack extension leads outside. These babies can be real gassers. The inside covers of the TM's are plastered with heads-up dope for safe-and-sane operation.

Always use the electric motor on your Engineer heater if the available power's compatible (Single phase or three phase).

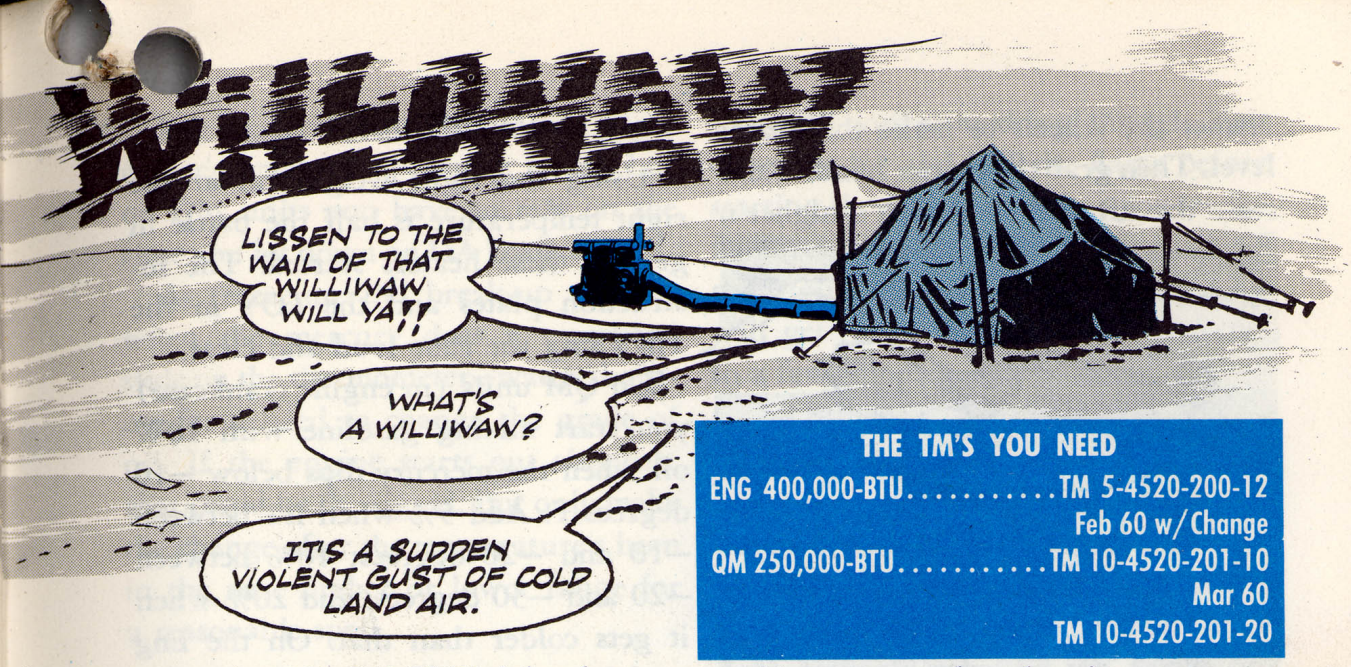


You'll get smoother operation with less danger of fire and carbon monoxide poisoning. The TM 5- is full of dope for you.

Here're some more things to knuckle down on before you reach for that starter. Drain the fuel filter every day without fail. Any water in there will freeze in the fuel control and put it on the blink. On QM units, drain the sump every day too. To make this chore easier,

1. SHUT OFF MAIN FUEL VALVE.
2. REMOVE SCREW AND NUT.
3. REMOVE FILTER AND DUMP CONTENTS.

PS MORE



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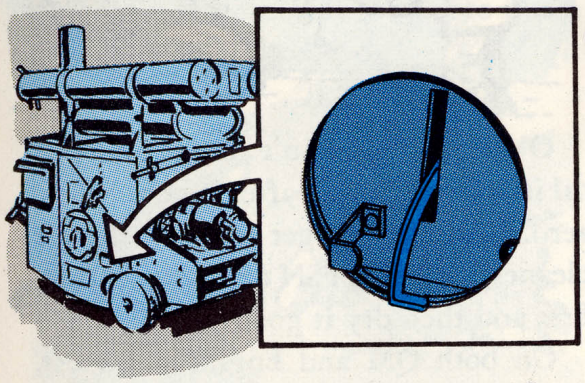

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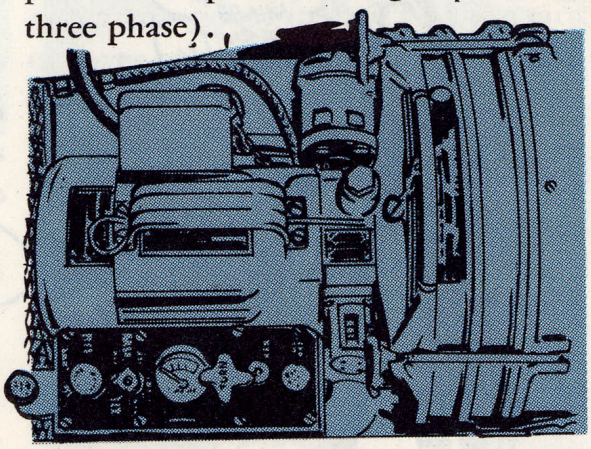

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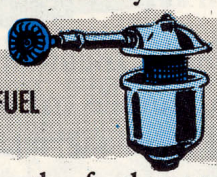
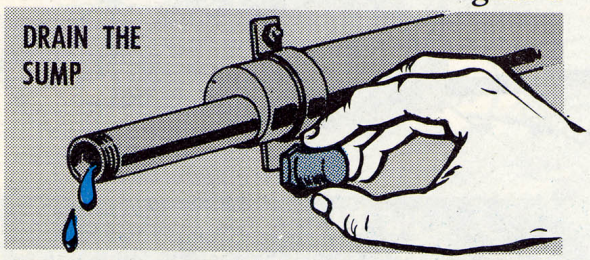


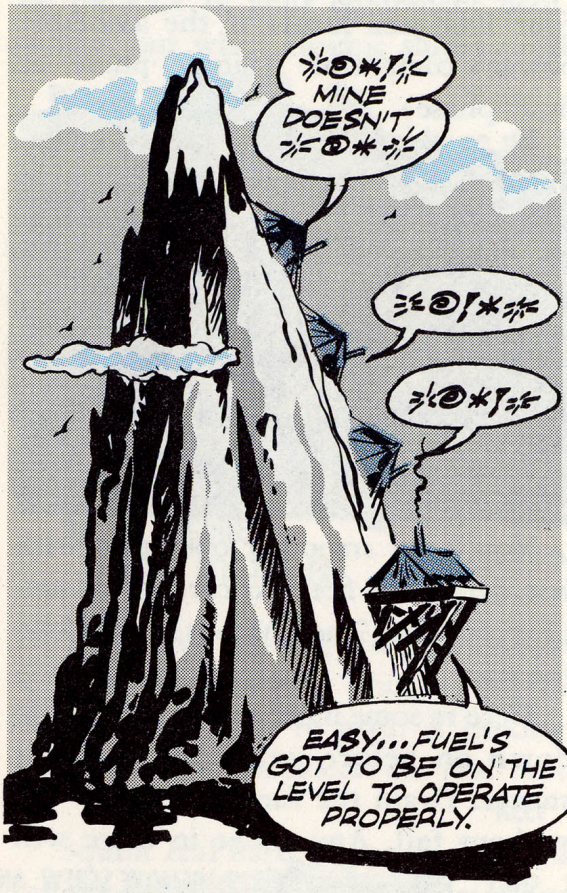
PS MORE

retract the wheels to make the heater level. Then grab the carrier handles and raise the aft end so that it's higher'n



the engine end. This'll keep gook from collecting at the far end of the tank.

And don't forget: All units have to be on the level when going. Otherwise you won't get an even flow of fuel



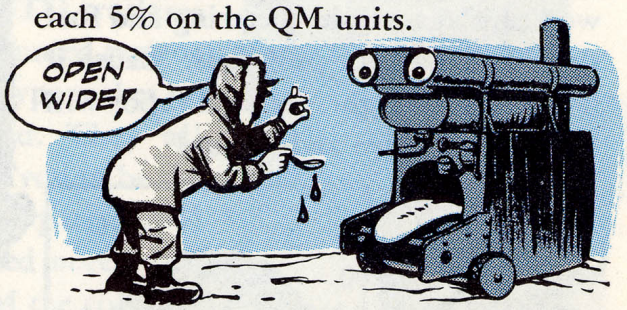
around the burners. Incidentally, if your unit has an altitude compensator indicator, switch it to the setting for the approximate altitude in your locality. This'll regulate the flow of fuel just right.

LUBE LORE

Using the right weight oil at the right temperature is half the battle in getting these heaters started. The instruction plates and the LO's in the TM's sing the tune loud and clear.

On QM units (in engine crankcase) you start mixing gasoline with 10W oil when the mercury dips below −10 degrees F. Add 5% when it's between −10 and −20 degrees; 10% between −20 and −30 degrees, and 20% when it gets colder than that. On the Eng models use OES oil as prescribed by LO 5-4520-200-12 (23 Dec 60) for temperature ranges from 0°F to −65°F.

Goes without saying that you'll always mix the oil and gas before pouring it in the crankcase. You can figure a tablespoonful or one ounce of gas to each 5% on the QM units.



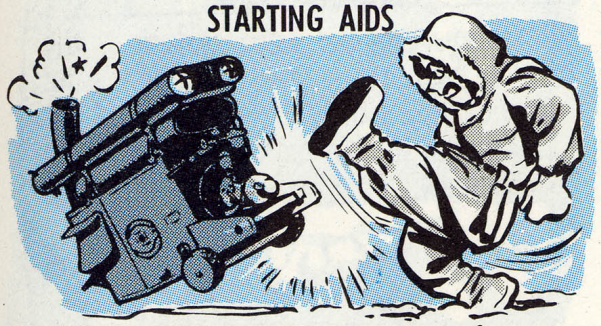
O'course, you won't forget and put oil in the air cleaner after it goes below zero. But don't forget to wash the air cleaner with SD (FSN 6850-285-8011) first and then dry it good.

On both QM and Engineer models, check the crankcase oil regular as clockwork—every 5 hours when the mercury's above zero and 3 hours if it's below zero. The oil's gotta be changed every 25 hours when operating in over-zero temperatures and every 12 hours when it's under zero. And check oftener'n that the colder it gets.

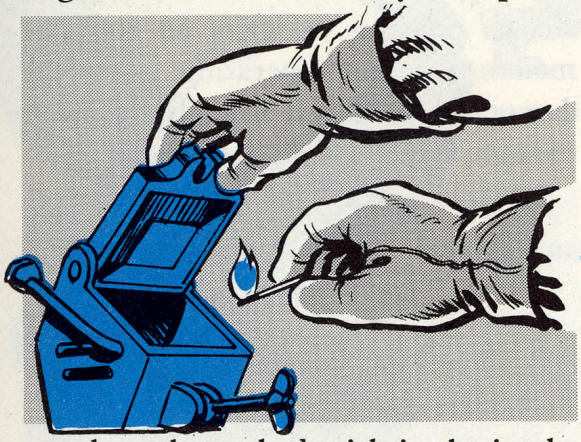
Eng models have time totalizer gages to keep track of operating hours, but on QM units you have to rely on the time you jot down on DA Form 2408-1.

At freeze-up and break-up times — when the mercury does a trombone slide on the thermometer—watch sharpest for a need to change the grade of oil. If the engine starts out sluggish, that could be the signal. But only make the change after the temperature's been in the next higher or lower range for a reasonable spell.

STARTING AIDS

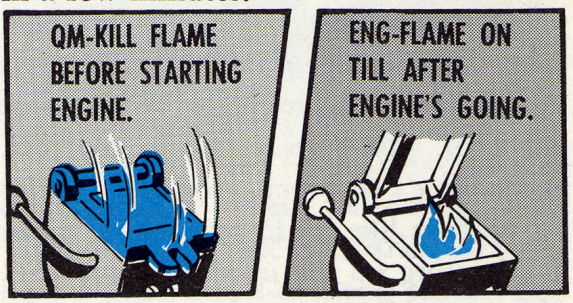


If the engine won't start up after you pull that rope a couple-three times, you might have to use some external heat to give it a boost. One way is to put a



match to the soaked wick in the intake manifold heater that's on most models. Para 16a in TM 10-4520-201-10 has the dope for the QM units, while para 34b in TM 5-4520-200-12 spells out this cold-weather tip for the Eng units.

You'll notice one thing, though. You close the lid and kill the flame before starting the QM engine, but you let the flames burn on the Eng model till after the engine's going. This pre-heating bit will get rid of frost on the carburetor in a few minutes.



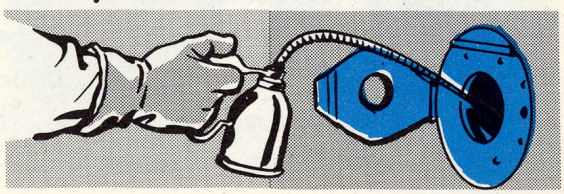
If this method won't work on the QM unit, you might try the blow torch system mentioned in the TM. Use a tarp or cover to make a tent around the engine and then use only mild heat, hear!

AND DOUBLE CHECK!

Keep on top of your mind that any leak in a fuel line, tank, gasket, valve, etc. while the burner's going can mean real bad trouble for everybody. Here're a couple ways to check for leaks in the 250,000-BTU models:

To test the safety trip valve, open the manually operated burner fuel shut-off and metering valves and then close the safety trip valve. If any gas gets through to the burner, you'll know the diaphragm's shot. Tell your support guys quick. Don't try to fix it yourself.

To check for leaks in the combustion chamber, shoot two or three squirts from your hand oiler into the access



PS MORE

door. Smoke should come out of the stacks. But if it also comes out of the ducts, you'll know the combustion chamber's burnt out or badly rusted. Shut the engine off pronto. Then hotfoot it for help. It means poison gas is going through the ducts.

And while you're at it, use your ears like radar screens to pick up any signs of trouble in the engine. If it misses or stalls or won't react fast to controls, something's gaflooey. And if it rattles or squeaks like it's in pain, could mean it's hurting on the inside. Report anything suspicious to your support people. Here're some symptoms to listen for:

Idles Too Fast — Carburetor needs adjusting.

Misses or Knocks—Valves sticking.

Overheating—Blocked up baffles, fins or flywheel.

And put your eyes to work on the burner flame. It should be a sharp-tipped yellow flame about six inches above the flame spreader. The flame should be the same all around too. If it's too low, too high or uneven, something's got to be wrong somewhere. Check it out and make with the fix. Here're some clues:

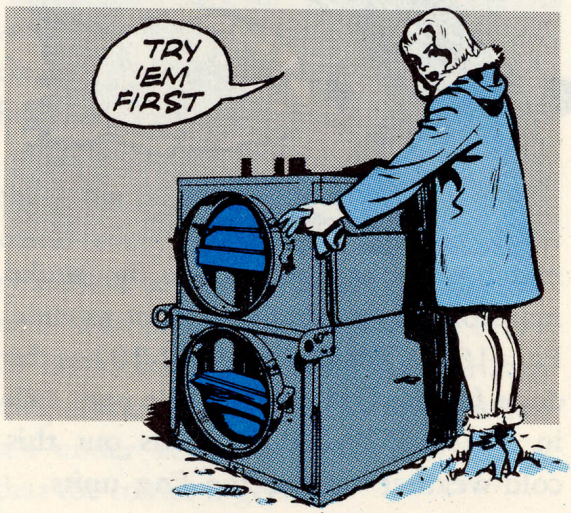
Too High — Exhaust stack, combustion air blower clogged; combustion air duct closed; engine speed too low.

Too Low—Clogged fuel line or sump; filter dirty; or maybe you're just low on fuel.

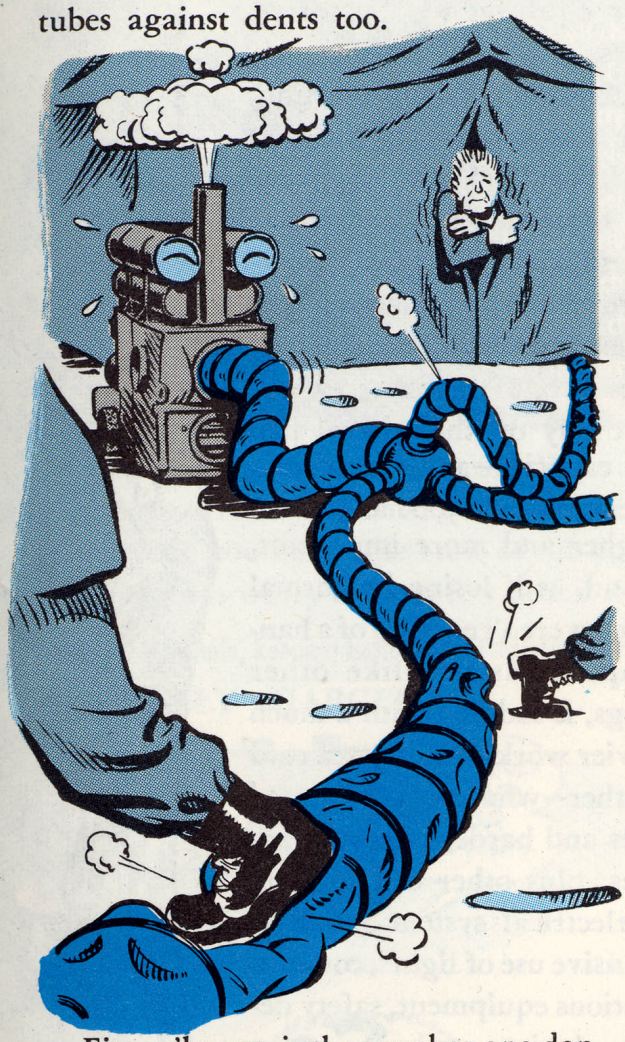
Uneven—Clogged valve system of the inner burner fuel line; or the unit's not level, or it's dirty or loose around the gasket at the bottom of the combustion chamber.

NOTES 'n STUFF

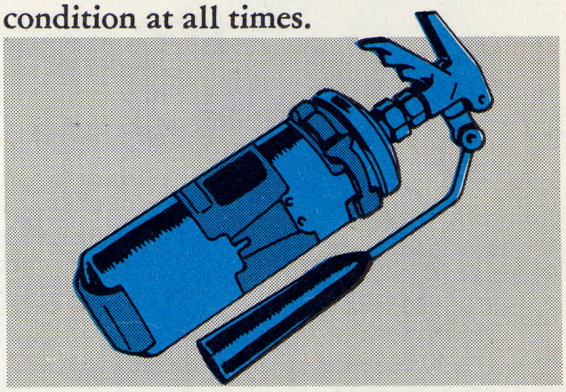
When the temp's real lowdown you'll probably have to close the discharge opening dampers on the QM model. But try operating with the dampers half closed first. If this isn't enough, close 'em all the way.



Spread the word to your buddies to keep their big fat mukluks off'n the ducts as they mush back and forth. If these ducts get twisted, worn or torn or plain trampled, they can't deliver. Make a habit of checking on 'em as you go about your business . . . especially for breaks, bends and damaged threads —all of which spell heat loss. And go outta your way to protect those storage tubes against dents too.



Fire, y'know, is the number one danger around these critters. The Eng model comes with a CF_3Br extinguisher (FSN 4510-555-8837—Eng). Change 1 (3 Jan 61) to the Engineer TM has the full scoop. For the QM models make sure there's an extinguisher of this or some other type right handy and in A-1 condition at all times.



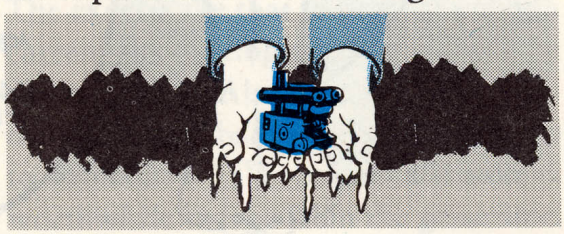
Incidentally, don't ever smoke around these heaters when re-fueling 'em. They're all allergic to sparks. Always keep a good metal-to-metal contact between container and tank when fueling up to keep static electricity under control.

Keeping water and gook outta the gas when re-fueling is quite a trick in these parts too. Use a chamois cloth or screen of some type while pouring. And watch out no snow or ice sneaks in the tank while the filler cap's off.

If you keep fuel stored in 55-gal drums, lay the drums slanted on their sides with the bottom end slightly higher'n the top end—that makes the hinge the low point, right? Water, being heavier than gas, will settle at the lower front end. This way the water'll come out first before you draw off pure gas for your heater.

ONE LAST THOUGHT

Always treat your heater like your life depended on it . . . it might.



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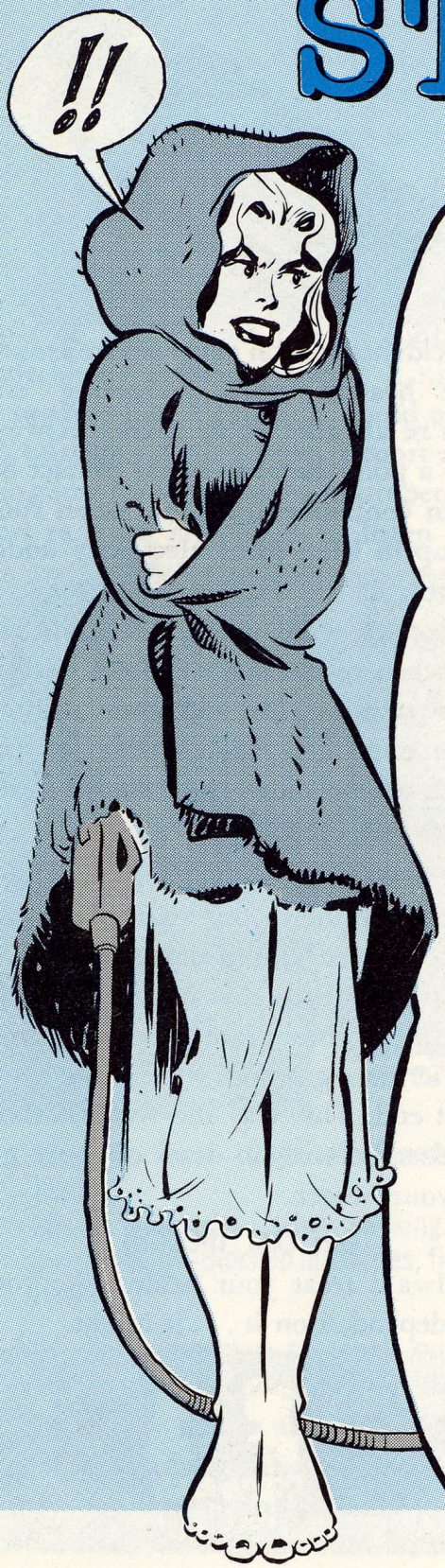
WHEN IT'S ICY . . . ALL OVER, YOU PAMPER YOUR FAVORITE— LEAD-ACID TYPE . . .

STORAGE



LISSEN...

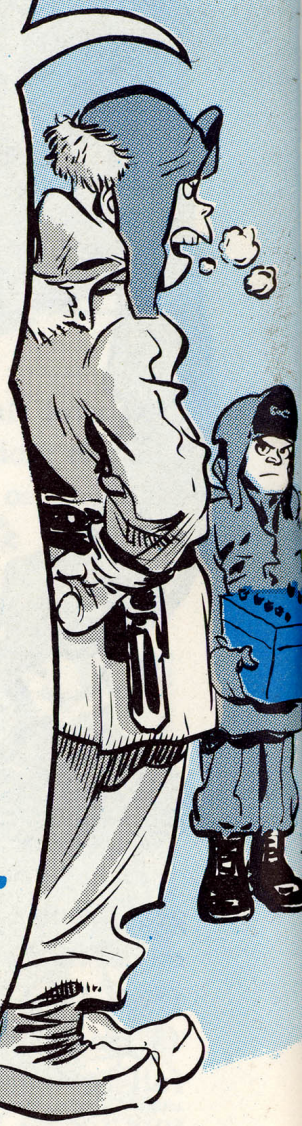
Low-down weather's rough on just about everything you've got, but it's especially hard on your equipment's batteries. Unless you give 'em thoughtful care and special protection, your lead-acid storage batteries will have about as much chance as a snowflake in the furnace.

Real cold, you see, slows down the normal activity of battery chemicals. It leaves batteries sort of helpless, so you can't rely on their usual pep and capacity—and that's at a time when their job has become tougher and more important.

And, as if losing its normal punch weren't enough of a handicap, a battery, like other things, is saddled with a much heavier workload in extra cold weather—what with congealed lubes and harder cranking engines, plus other demands on an electrical system (such as extensive use of lights, communications equipment, safety devices, slaving, etc.).

SO...

KEEP THEM BATTERIES IN SHAPE... CONNIE CAN'T GET ENOUGH JUICE OUT OF OUR STUFF TO RUN HER BLANKET WARM!!



WHEN IT'S ICY . . . ALL OVER, YOU PAMPER YOUR FAVORITE— LEAD-ACID TYPE . . .

STORAGE BATTERIES

Here's how a battery's charge effects its cranking ability:

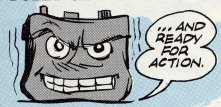
TEMPERATURE	HYDROMETER READING (SPECIFIC GRAVITY)	CRANKING ABILITY
80°F	1.280 (Full charge)	100%
80°F	1.225 (Half Charge)	46%
80°F	1.180 (Nearly discharged)	
32°F	1.280 (Full charge)	65%
32°F	1.225 (Half charge)	32%
32°F	1.180 (Nearly discharged)	16%
0°F	1.280 (Full charge)	40%
0°F	1.225 (Half charge)	21%
0°F	1.180 (Nearly discharged, and in danger of freezing)	9%

According to the men with the slide rules it takes two-and-a-half times as much power to turn an engine at 0°F, as it does at 80°F.

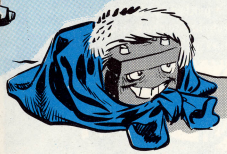
How do you soften the blow of sub-zero temps on your battery? Easy—all you have to do is worry about a few dozen things ahead of time.

Like, for example, keeping batteries—AT ALL TIMES:

1. **FULLY CHARGED** ..... And, that means a specific gravity reading of 1.275 to 1.300, corrected to 80°F (electrolyte temp). A fully charged battery can take it up to —90°F. A low battery (1.100 specific gravity) will freeze at +19°F.



2. **WARM** ..... The warmer you keep a battery the harder it can pull for you when everything else is stone cold and sluggish. The experts say that to provide enough current for starting a battery should be above +20°F. Also once you get equipment going a battery has to warm up to around +35°F before it'll take a worthwhile charge from the generator.



PS MORE

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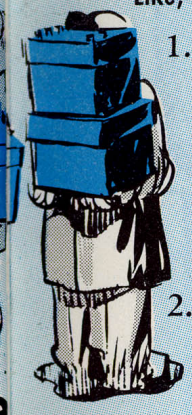
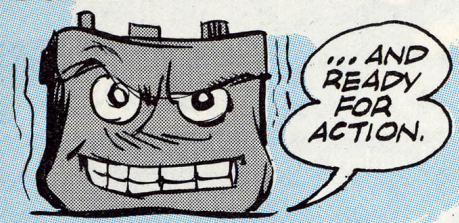
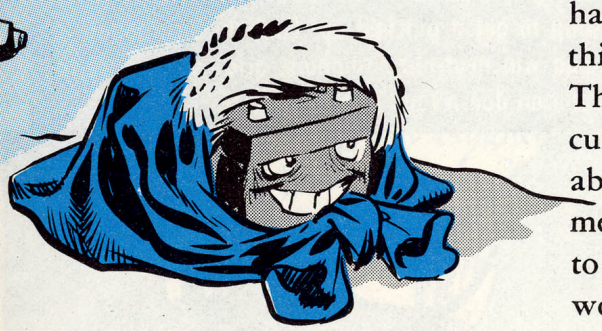


1. **FULLY CHARGED** ..... And, that means a specific gravity reading of 1.275 to 1.300, corrected to 80°F (electrolyte temp). A fully charged battery can take it up to —90°F. A low battery (1.100 specific gravity) will freeze at +19°F.

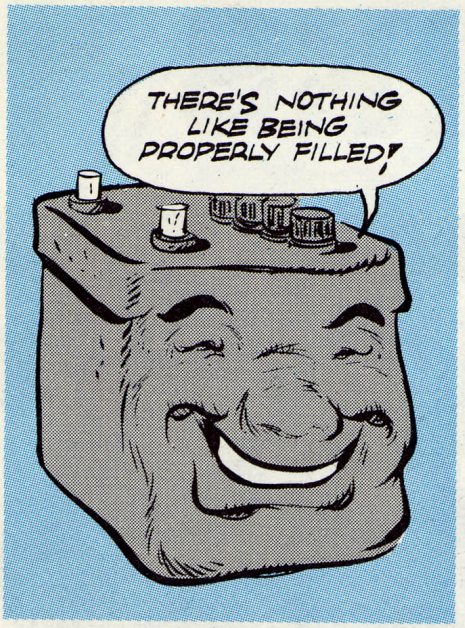


2. **WARM** ..... The warmer you keep a battery the harder it can pull for you when everything else is stone cold and sluggish. The experts say that to provide enough current for starting a battery should be above +20°F. Also once you get equipment going a battery has to warm up to around +35°F before it'll take a worthwhile charge from the generator.



P.S. MORE

3. **PROPERLY FILLED** ..... Fill to level mark given on cell cover, and in any event to above plates . . . but never overfill it. A flooded battery's no good either . . . it's not only messy, it has to go back to the shop to get serviced. As always use distilled (if possible) or cleanest, freshest water available. Any clean water (like rain-water), however, is OK, and even the kind you drink is better than letting a battery go dry. Batteries for extreme-cold use get a stronger solution, but the mix is something for your battery man to worry about. You're never to add electrolyte or acid in place of water. If electrolyte spills or leaks, it's up to the experts to re-service the battery. (Adding acid or electrolyte to a battery, in place of water, can cause a battery to freeze faster, and also harm its innards.)

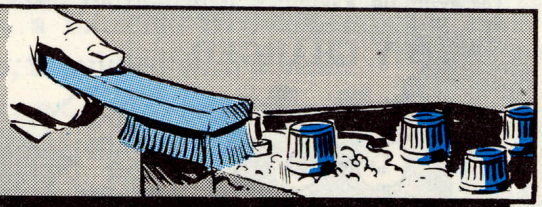


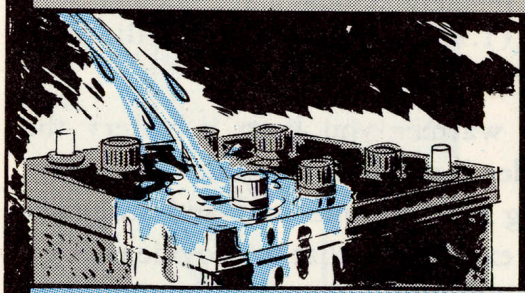
Yep, there's only one way to make sure your batteries have a fighting chance in the low-down cold, and that's to check 'em daily. It's a **d-e-m-a-n-d-i-n-g** job, and a steady one, alright. But, you may as well be cheerful (OK, understanding!) about it . . . 'cause without a hot battery nothing's going no-place, no-how.

PM's SPECIAL

Even routine care is a highly critical business for batteries in cold weather operations. So in addition to giving them good cold-weather care, you do the usual stuff with special care, and:

Keep battery tops really clean, no corrosion, and brush off all snow, frost and trash. Use a fibre or bristle brush dipped in a soda-solution—½ pound bicarbonate soda to one gallon of water—to scrub off corrosion.

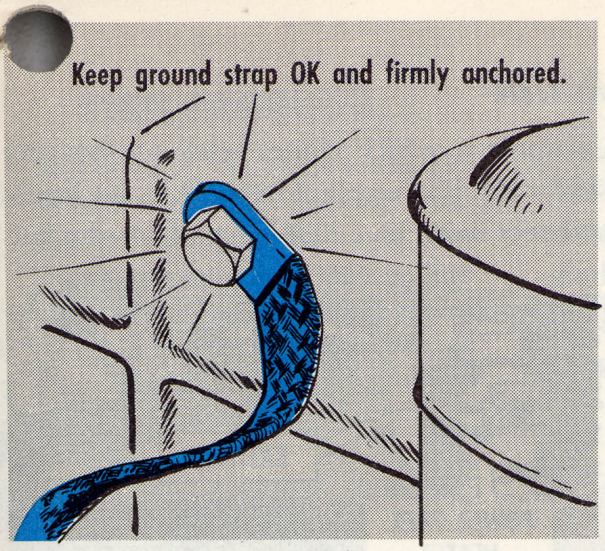


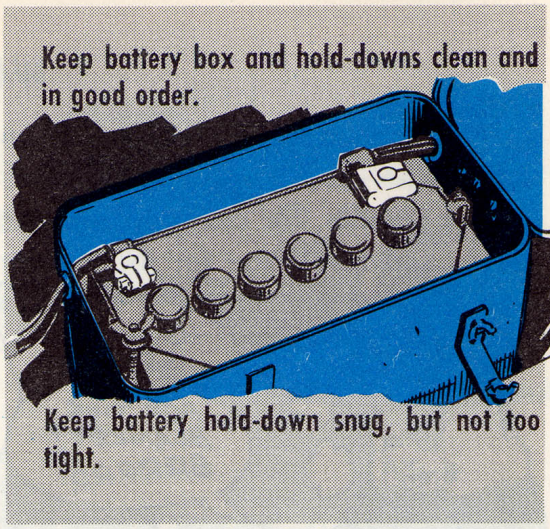


Flush top of battery with clean water when the foaming stops, and then wipe it dry with a clean cloth. Never wash a battery this way, however, if its top is cracked or blistered. Send it back to the shop to get it patched up. Caution: Bicarbonate of soda will neutralize sulphuric acid—so be sure the solution doesn't get into the cells.

Keep vent plugs tight and un-plugged.

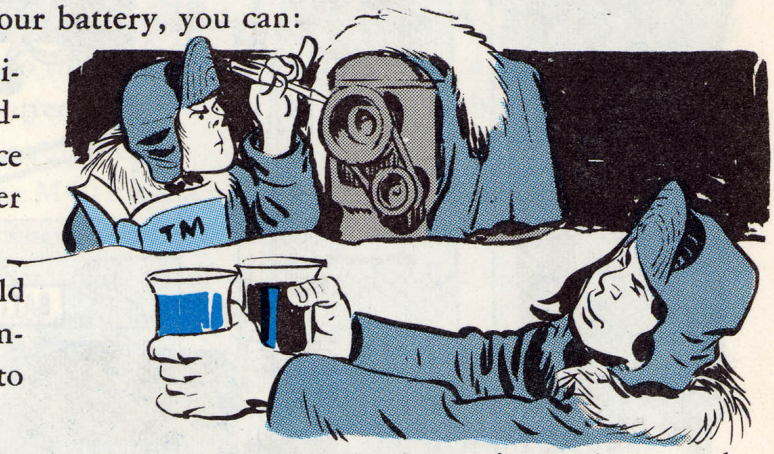
Keep cables, clamps, terminals, clean, tight and in good shape. (No cracks, breaks or dirt and terminals protected with a light coat of GAA or asbestos grease.)





CHARGING/CHECKING/SPECIAL CARE

For all around help for your battery, you can:



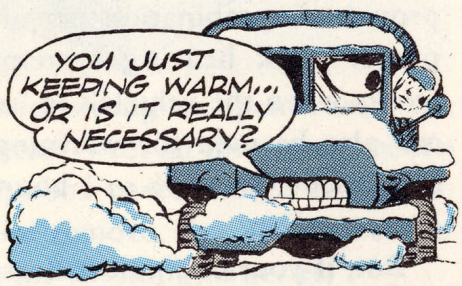
1. Keep engine fit as possible (tuned-up, timed, all adjustments per the maintenance manual's info on cold weather operations).

2. Use proper mix of cold weather fuels and the recommended lubes and greases to insure quicker cranking.

3. Stick close to cold weather starting instructions in the equipment's manual. If the engine doesn't catch on quick, turn off all the engine starting switches and wait several minutes. You'll give the starter time to cool, and also, a battery's discharge will often be followed by a short recovery (charge). Those few minutes of build-up (charging), even at a low current, can often provide just the flash of energy you need to start the engine on the next try.

4. Running the engine to re-charge the batteries is OK'd if the operator sticks close to keep an eye on the charging rate, and to watch engine operation. Around 1000 to 1200 rpm (approximately 20-25 miles road speed) is OK'd for battery re-charging on most engines . . . best check your equipment's manual on this, tho.

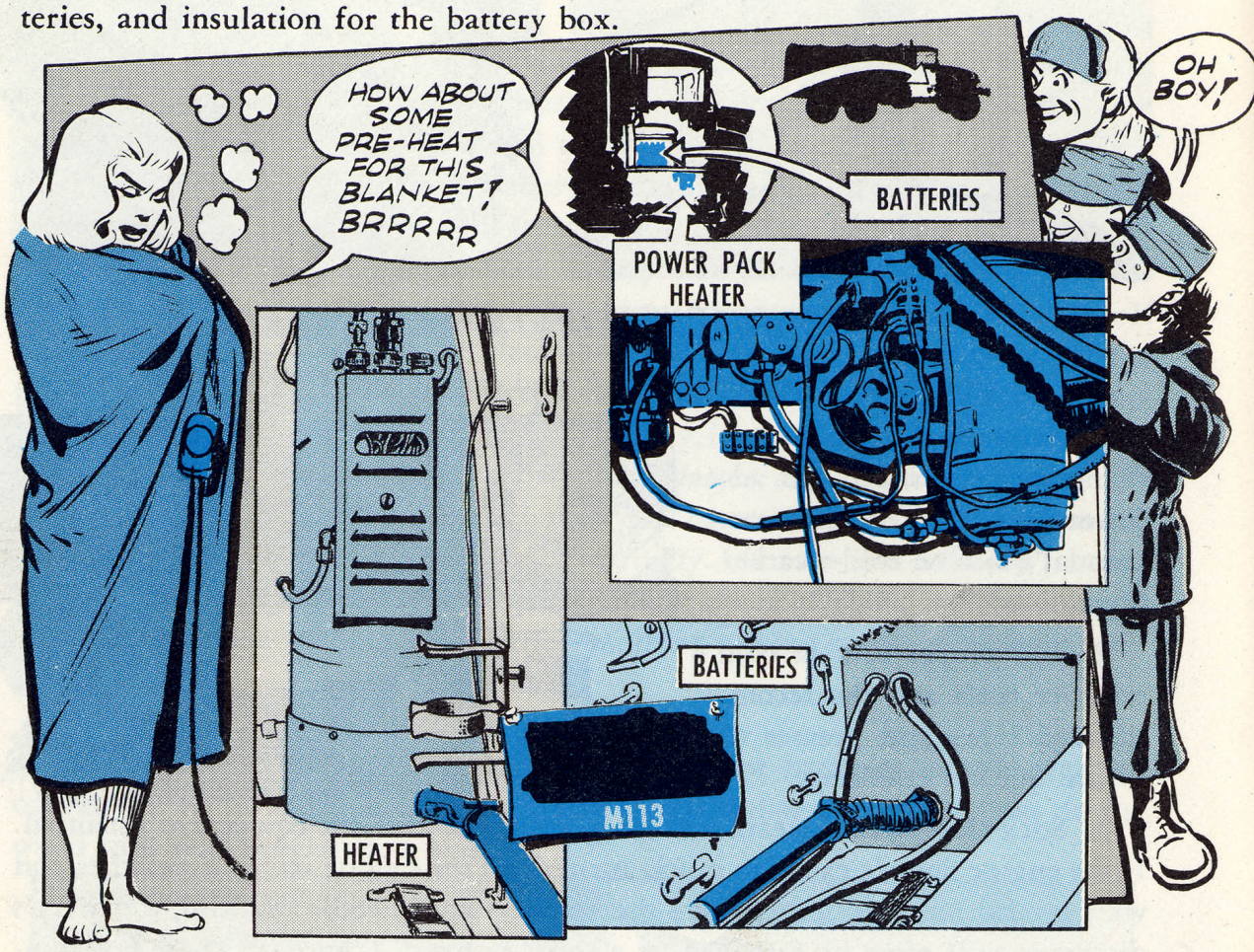
5. Engine idling at very low speeds, when accessories are applying load will discharge batteries. So best you don't get caught idling an engine too low—and just to keep yourself warm—it not only hurts the batteries, it's rough on engine life, and it jacks up the cost of maintenance and operation.



P.S. MORE

WARMING

Warmth-wise, batteries do OK on equipment which comes with pre-heating accessories—or if it uses a power plant heater kit. Power plant heater kits for liquid cooled engines, for example, provide a direct duct, or a heating pad for the batteries, and insulation for the battery box.



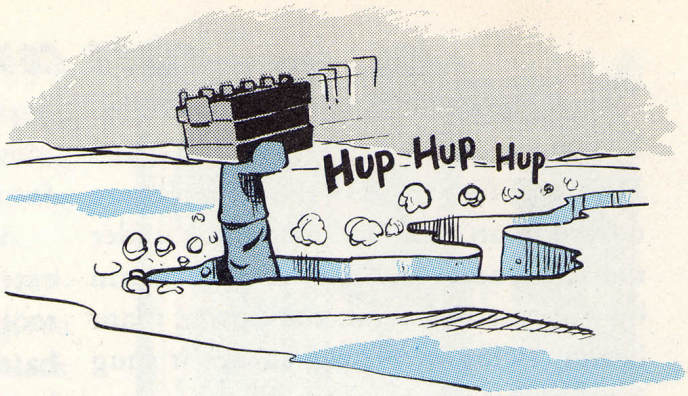
Some of the heater kits are for use only when equipment's on standby, or for overnight heating. That is, when the equipment itself isn't in operation. Other winterization kits (like on the newer track equipment, for example) provide a combination personnel and power pack heating system, which works when the vehicle's in use, and it can also be used for warming up the equipment (from ½ to 1 hour) before it's started up.

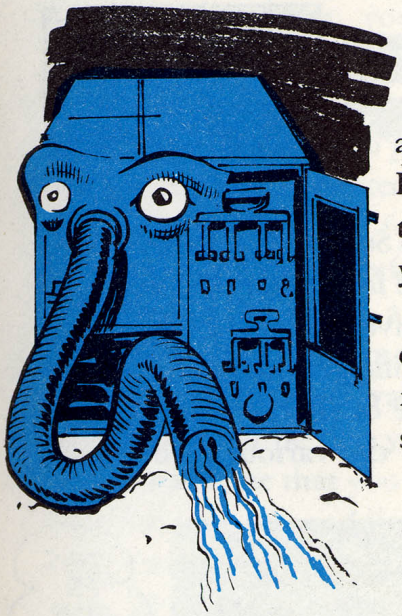
But, if your equipment doesn't use a heating kit, and it has to live outdoors, you have to keep its batteries warm as best you can. Like taking them indoors at night, and maybe even during long standby, so they'll be ready any time.

Remember, tho—batteries should be heated gradually, and take care you don't over-heat 'em . . . just so's they're comfortably warm to your bare skin, is a good rule of thumb. Heating them too fast (or too much) can crack the case. And, by all means keep them away from open flames and sparks.

MAN-HANDLING...

And, of course, where there's to be a lot of extra lifting, totin', replacing, checking, and cleaning (under maybe more clumsy and unpleasant conditions than you're used to) you have to be mighty patient so batteries don't suffer damage from rough handling (dropping, jerking, slamming, and the like.)





CANNED HEAT

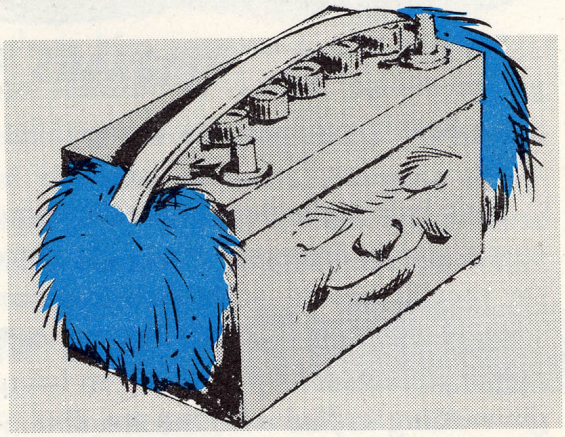
If you can use only portable heating equipment (like a Herman-Nelson heater, or the M40 Cold-Aid Starting Kit) to thaw out your equipment, you naturally include the batteries in the warm-up exercise before you start up your equipment.

The M40 kit is a real blessing when it comes to starting equipment with low, or cold batteries, on a frozen morning. See page 16 of this issue for use of the M40 kit on starting equipment.

The M40 can also be used in an **emergency** for charging batteries. But that's a job for someone who knows the M40, its TB Ord 390, and his equipment real well.

BOX COVER

On equipment with exposed batteries (which you can't take indoors), you can do other helpful things . . . like putting insulation in the battery box. Stuff like rock wool, asbestos, spun glass fiber, cellulose fiber and other non-metallic materials are OK. You insulate all sides and the top and bottom of the box, and attach the material with wooden strips. If you use bolts or screws on the strips be sure to countersink the heads so the metal won't touch the battery. **Also, be sure that the battery box drain holes are open after you insulate the battery box.**



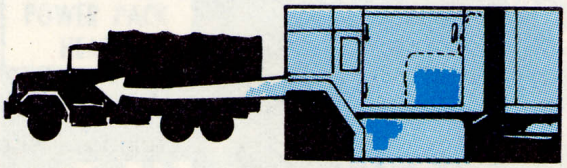
Batteries sitting on open frames can be protected with an insulated wooden box. The box cover should be easy to reach and remove, tho, so it'll be convenient for checking batteries.

P.S. MORE

CLOSE COVER

On some vehicles (like the M34 2½-T, 6x6, cargo truck, the M41, M51, and M52 5-T, 6x6 trucks) the batteries are moved to an insulated metal box under the front seat, and they're kept warm by a direct line from the power plant heater. Being in the cab makes it snug for the batteries, but with this set-up you have to be very careful about keeping the battery box closed and the seat down, when you're in the cab. Especially when you're working with any kind of tools. If you cause a spark when the batteries happen to be gassing just a little bit too much, they could blow up right in your face.

As a matter of fact, you've got to be extra careful anytime you're handling tools or other metal objects around hot batteries . . . don't drop 'em or hit the battery box and don't get careless about smoking around them either.



CHECKING 'EM

The best argument in favor of checking batteries daily is the fact that a low battery not only won't deliver . . . it'll freeze fast. Take a look at this chart.

Electrolyte Reading (Corrected to 80°F)	Freezing Point (°F)
1.280	−90°
1.250	−62°
1.200	−16°
1.150	+ 5°
1.100	+19°

So, you see, in extreme cold you've got no choice. To stay in business you gotta keep your batteries charged just right.

Let's halt right here and talk about correcting hydrometer readings. Since the specific gravity scale on a hydrometer is correct only at 80°F, you have to juggle the figures up or down to bring the reading in line with the actual temperature of the electrolyte you just sucked up into the hydrometer. You knock off four points of specific gravity for each 10°F below 80°F, or you add four points for each 10°F above 80°F.

TM 9-207 (Sept 59) on care of Ordnance material in extreme cold weather, on page 53, gives a handy chart listing corrected specific gravity readings, and the percentage of charge which can be counted on at the various readings:

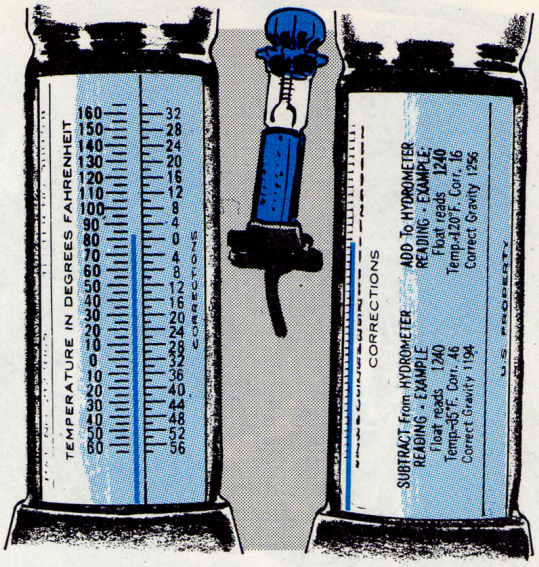
Temperature (° F.)	Specific gravity: Hydrometer reading	Corrected to +80° F.	Percent of charge, about:
+80	1.280	1.280	100
	1.250	1.250	75
	1.220	1.220	50
	1.190	1.190	25
	1.160	1.160	Little use
0	1.312	1.280	100
	1.282	1.250	75
0	1.250	1.220	50
	1.222	1.190	25
	1.192	1.160	Little use
−10	1.320	1.280	100
	1.290	1.250	75
	1.260	1.220	50
	1.230	1.190	25
	1.200	1.160	Little use
−20	1.324	1.280	100
	1.294	1.250	75
	1.264	1.220	50
	1.234	1.190	25
	1.204	1.160	Little use
−30	1.328	1.280	100
	1.298	1.250	75
	1.268	1.220	50
	1.238	1.190	25
	1.208	1.160	Little use
−45	1.334	1.280	100
	1.304	1.250	75
	1.274	1.220	50
	1.244	1.190	25
	1.214	1.160	Little use
−35	1.340	1.280	100
	1.310	1.250	75
	1.280	1.220	50
	1.250	1.190	25
	1.220	1.160	Little use

The hydrometer (FSN 6630-335-0367, hydrometer, syringe, lead-acid battery), also gives info on correcting specific gravity readings, right along side its thermometer.

For example, you take the float reading, and if the correction figure given opposite the thermometer is in the black column, you add the "correction" figure to the float reading. If the correction is in the red column, you subtract the "correction" figure from the float reading.

That's all there is to getting an electrolyte reading corrected to 80°F. You can clip out the chart, for your wallet, if you want a handy reference.

To be in top shape, a battery's cells should read pretty much the same. When cell readings vary just a few points it could be that you've used too much water, or that you took the readings too soon after adding water. However, when cell readings vary more than 25 points, it can mean there's serious trouble in the battery's guts, so get it off the equipment and into the battery shop soon's you can.



You're never to add water to a cold battery. In subzero weather (if a battery's not charging) the water'll stay on top and can freeze before it can mix with the electrolyte. Get your electrolyte temp up to around +40°F before water's added. So, unless a battery's warm, or you can operate the equipment for at least one hour after adding water, it's best to take the battery indoors and warm it up before you water it.

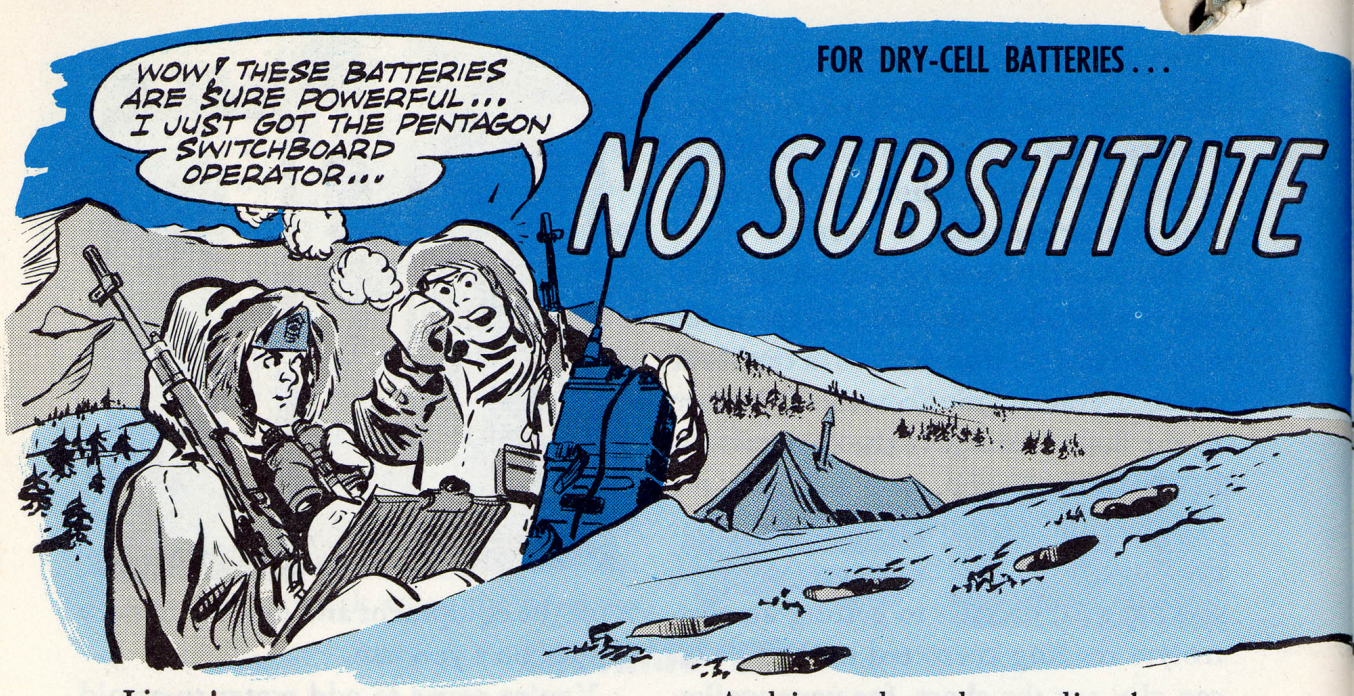
IN CHARGE OF CHARGING

And, incidentally, when you're responsible for the charging end of the battery business, you need the facts and figures on charging methods, charging equipment, etc., given in TM 9-6140-200-15 (Jul 58) "Storage Batteries Lead-Acid Type". It's a good guide for battery men in all echelons . . . so grab yourself a copy.

THE FROZEN ONES

A frozen battery has to go indoors to thaw out slowly at room temperature. And, freezing, if it goes far enough, can tear up a battery inside and out (container breaks, plates crack or buckle, and the separators crack). So you have to look 'em over carefully after thawing 'em out. Also, a frozen battery never goes on the charger . . . (or on equipment, naturally) — the grids will get damaged, and the active materials will break down.

END



FOR DRY-CELL BATTERIES . . .

NO SUBSTITUTE

Listen!

The howling and moaning frenzy of nameless and numberless demons roaring in the storm cannot drown it out entirely.

And in the icy calm and frigid stillness of the lull that follows and the lull that precedes, it comes in loud and clear—birdsongwise.

It is the "message"—the wee small voice of command and companionship that creates and defines an isle of sanity in a trackless and indifferent wilderness.

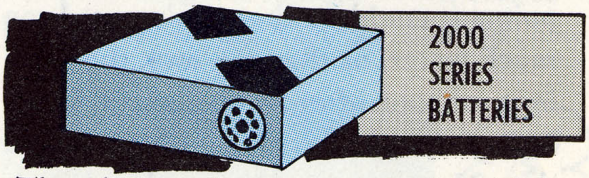
And behind the message—somewhere—you'll find a dry cell battery almost small enough to put between two slices of bread. Small, yes . . . but powerful enough to tackle both distance and demon and come out crowing every time.

All it expects in return is a little human warmth and understanding.

It needs human warmth because that's the only kind it can get most of the time it's operating.

And it needs understanding because without it, it may not get the warmth.

When you're in a cold-weather area, you're issued special cold-weather dry cell batteries (those in the 2000-series).

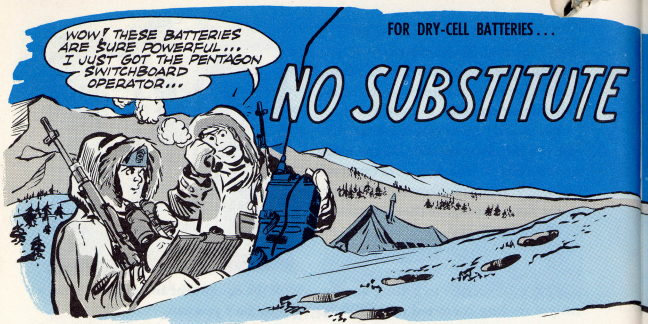


They have a lot more oomph to them than your regular batteries—but you have to handle 'em just right to get the benefit of it.

When the internal temperature of a dry cell battery dips much below zero, the capacity of the battery is so small it's hardly worth mentioning.

At real low internal temperatures, the only difference between a cold-weather battery and a regular one is that the cold-weather battery will sorta die with its boots on. The regular one just dies, period.

So you might say that when a cold-weather battery is warm, it's very, very good—but when it's cold, it's frigid.



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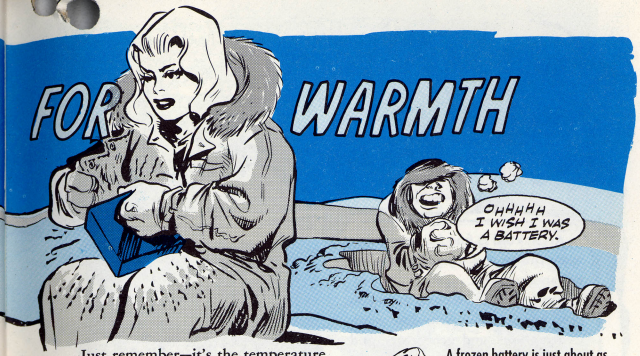
NO SUBSTITUTE FOR WARMTH



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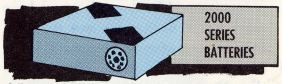

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Just remember—it's the temperature of the battery that counts. A warm battery will work well in the coldest temperatures until it begins to get chilled itself. But a frozen battery won't put out at all, even in a warm temperature until it warms up.

Here's where the human warmth comes in. Treat those cells just as if they were part of your own body . . . because in a sense they represent your ears and your voice.

If your battery dies of coldness, you and your unit may become both deaf and mute in an area where silence can mean death.

When there's no other source of heat, keep your batteries inside your clothing, wrapped in as much insulation as you can manage. Always carry as many extra batteries as possible.

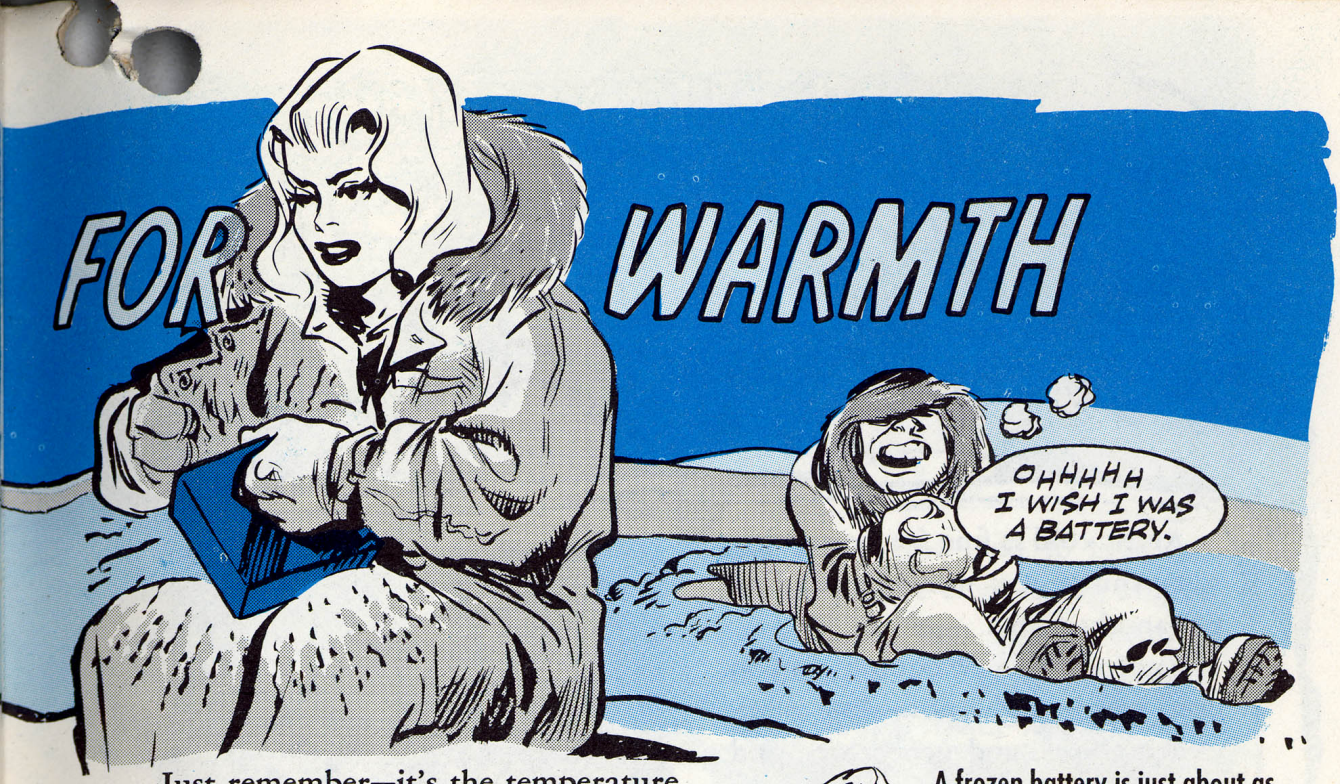
Slip the batteries into their sets only when necessary . . . and change 'em for warm ones the first chance you get. Use any insulating material you can get your hands on to keep your set warm after you put the battery in.

A frozen battery is just about as useful as a frozen steak. But in both cases, what the cold has taken away, heat can bring back.

In an emergency, you can heat a battery over a fire or stove . . . but it's much better to let them warm-up gradually in a heated shelter. When they're brought into a heated area they'll sweat, so you should keep them wiped off as much as possible to keep ice from forming.

Since cold-weather batteries are intended for cold-weather use they shouldn't be exposed to temperatures much above 70° F. for long.

So warm up only as many spares as you'll need—and store the others at a temperature below 35°F. This cold-storage suspends the chemical action and makes the batteries last much longer on the shelf.



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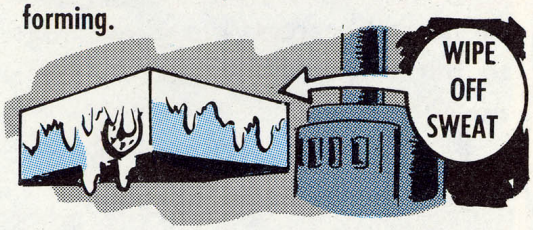

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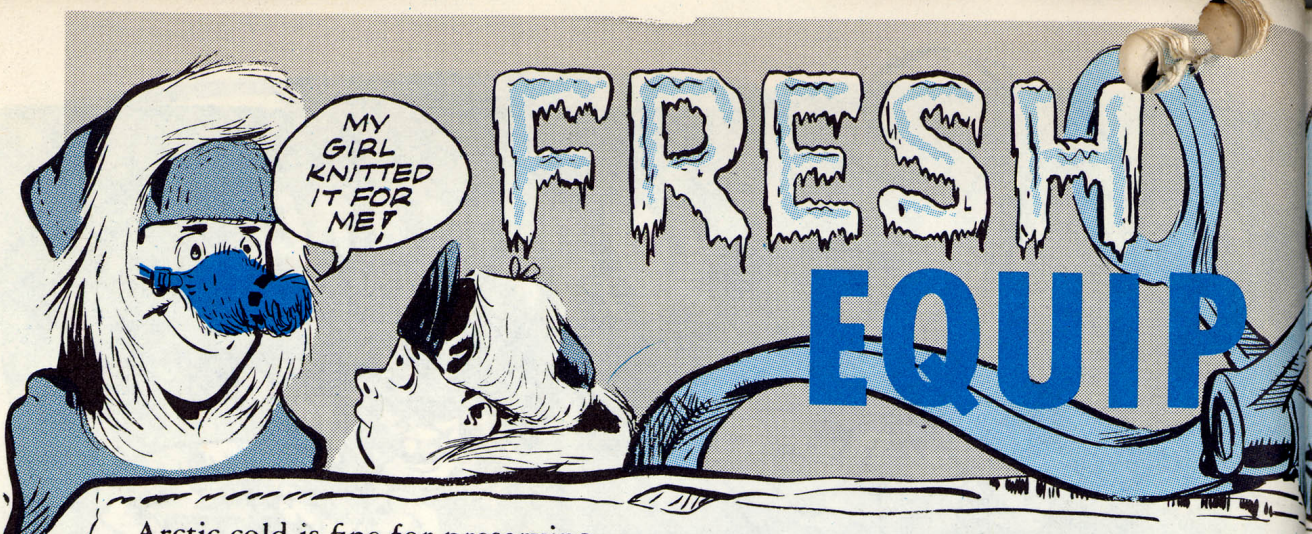
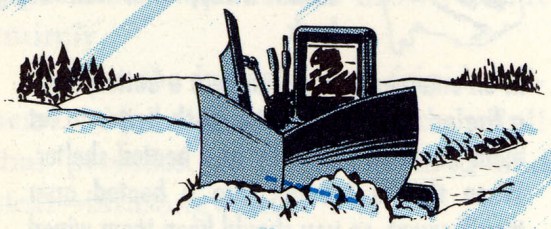


FRESH EQUIP

Arctic cold is fine for preserving some things you won't be needing till another time.

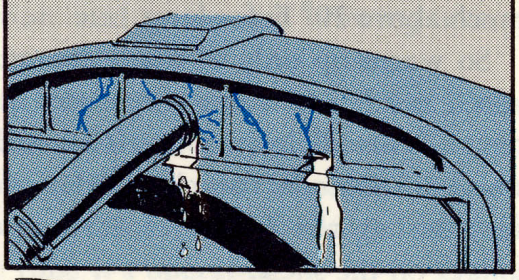
But for Engineer equipment you need to use right now—like road-clearing rigs, and generators, and compressors—nothing can put you out of business quicker than this same Arctic cold.



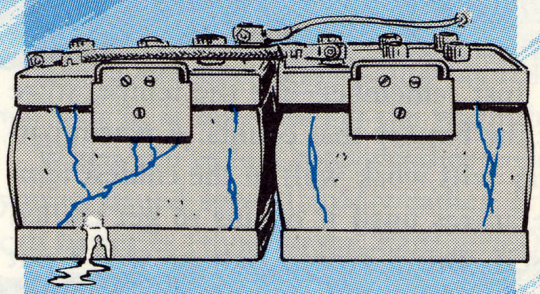
"Not me" sez you. "I've got primers, and heaters, and glow plugs to burn. It can't get too cold for my equipment."

Fair enough—**if your equipment's in shape to operate.**

But it'll be in no shape to operate if you let the Arctic antifreeze thin out, and the cooling system cracks up.



It'll be in no shape to operate if you leave its undercharged battery out where Arctic cold can bust out its cells.



And it'll be in no shape to operate if you fail to free up the fuel supply with alcohol. It takes a snort of alcohol—about 1 quart to 30 gallons—to keep the water in gasoline from icing, and to keep diesel fuel from waxing.

In other words, starting aids can get live equipment going. But you can't expect 'em to wake the dead.

Those aids have work enough when equipment's in A1 shape, and soaked to the core with Arctic cold.

IT TAKES HEAT

Some of your Engineer items—like generators—rate their own heated shelter. And a few of your busiest mobile rigs might find overnight shelter in the service shops.

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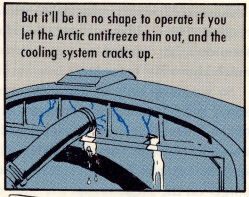

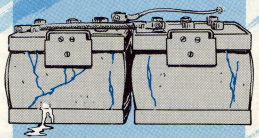

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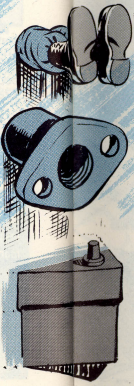


But mostly—except for an assist from the duct type portable space heaters—your outdoor starts have to be made with the heaters that come with your Engineer equipment.

Specially with outdoor starts in Arctic cold, you have to throw heat into an engine at least an hour before it warms up enough to start. On some engineer equipment, you may have to keep heaters operating all through the run, when the weather's extremely cold and windy.

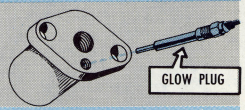
Even with a fully charged battery, it takes heat to bring up enough capacity for Arctic cold starting.

It takes heat in the air intake system to keep fuel charges from condensing and flooding the engine before you can get it to fire.

And even with fresh clean OES, it takes heat on the crankcase to loosen the oil so your starter can spin the engine—and so lube can flow to all the close-fitting engine parts in the first critical seconds of operation.

AND IT TAKES TIMING

With **glow plugs** to warm up your diesel nozzles, you want to apply heat **before** the start—as much as 1½ minutes in real Arctic cold. When the engine catches and runs, you switch off the glow plugs and save 'em for the next start.



With **primers,** as a general rule, the time to prime is right **after** the starter takes hold and begins to turn the engine. Until then, there's no suction at the intake and no pressure on the fuel pump.

Priming too soon, or too much, can flood the engine or set up the danger of a damaging backfire.

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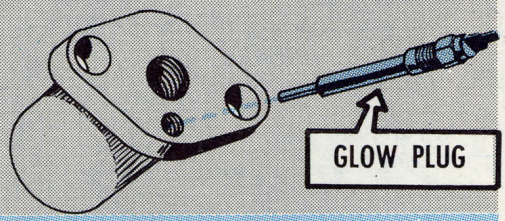

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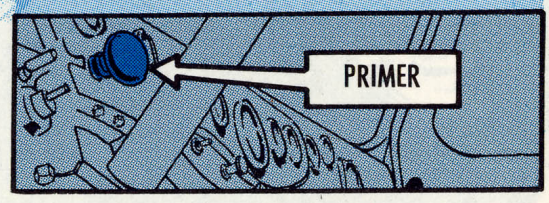

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THAT SNOW STORM BREWIN' COULD BE...

THE BIG

So you just got the word!

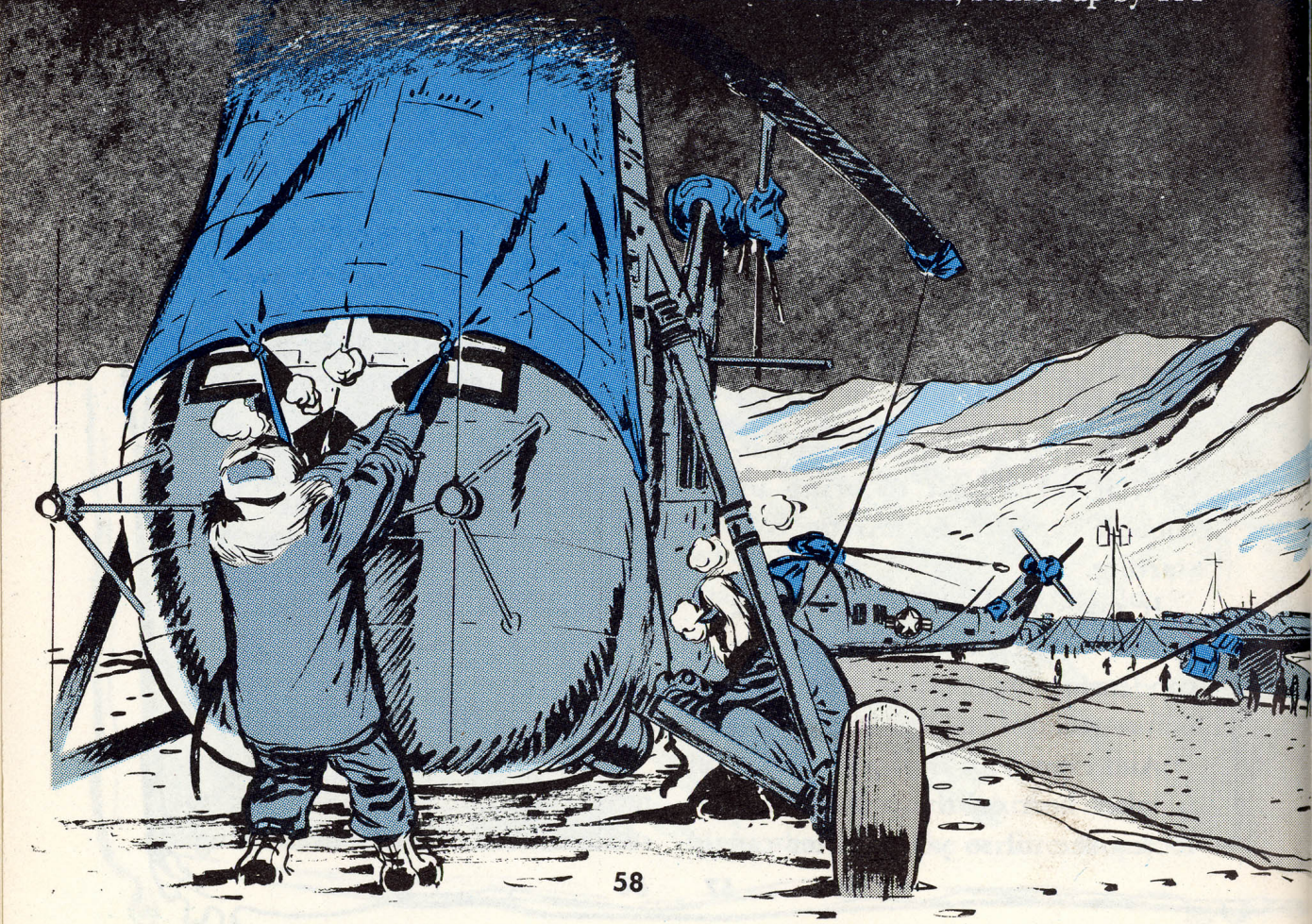
Dame Nature's kickin' up her heels again with a monster of low pressure headed your way, loaded with snow. It's a good thing you kept an eye peeled on the weather forecast . . . you've just got time to protect your aircraft from the storm.

'Course the best protection you can get is a nice warm hangar. But if there isn't enough space to go around, your bird's goin' to take it right on the chin . . . especially in boondock operations where there's no hangar space at all.

You can soften the blow by moving your bird to any spot that'll give the best protection, natural or man-made... and then using your mooring kit and steel chocks. You can use either FSN 1730-268-9821 (should be coming into the supply system soon) or 1730-268-9822, (SM 55-135-1-4), whichever chock you need. Just be sure to moor your bird facing into the storm winds.

USING COVERS

And what about using your bird's covers? They can save you a lot of snow clearing work after a storm! Your maintenance manual, backed up by TM



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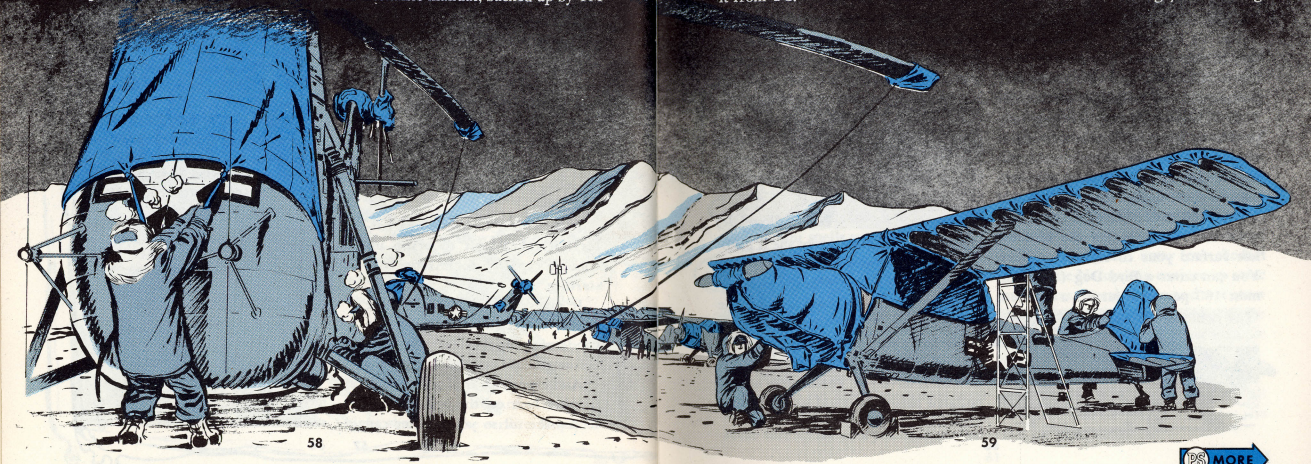
But before you put the covers on you'll save yourself a big headache if you first coat your ship with Lithium Chloride, FSN 6850-285-8002, defrosting-deicing fluid, MIL-F-7946. This fluid comes in 5-gal cans and the -20P for your bird is the authority to order it from TC.

The only thing is, before you use the fluid, you've got to follow TB AVN 23-13 "Anti-Icing, Deicing, and Defrosting of Parked Aircraft" (3 May 60) . . . a revision to the TB should list the lithium chloride. There are safety tips and certain ways to use the deicing fluid that you'll want to follow, step by step.

If you don't use deicing fluid before you put the covers on, blowing snow may get up under the covers and freeze 'em to the bird—making 'em mighty tough to get off . . . like trying to peel an orange with gloves on.

When the storm's over and you take the covers off, you'll find the combination of deicing fluid and covers will shed snow and ice like a duck sheds water—beats the back-breaking job of taking



DA PAM MORE

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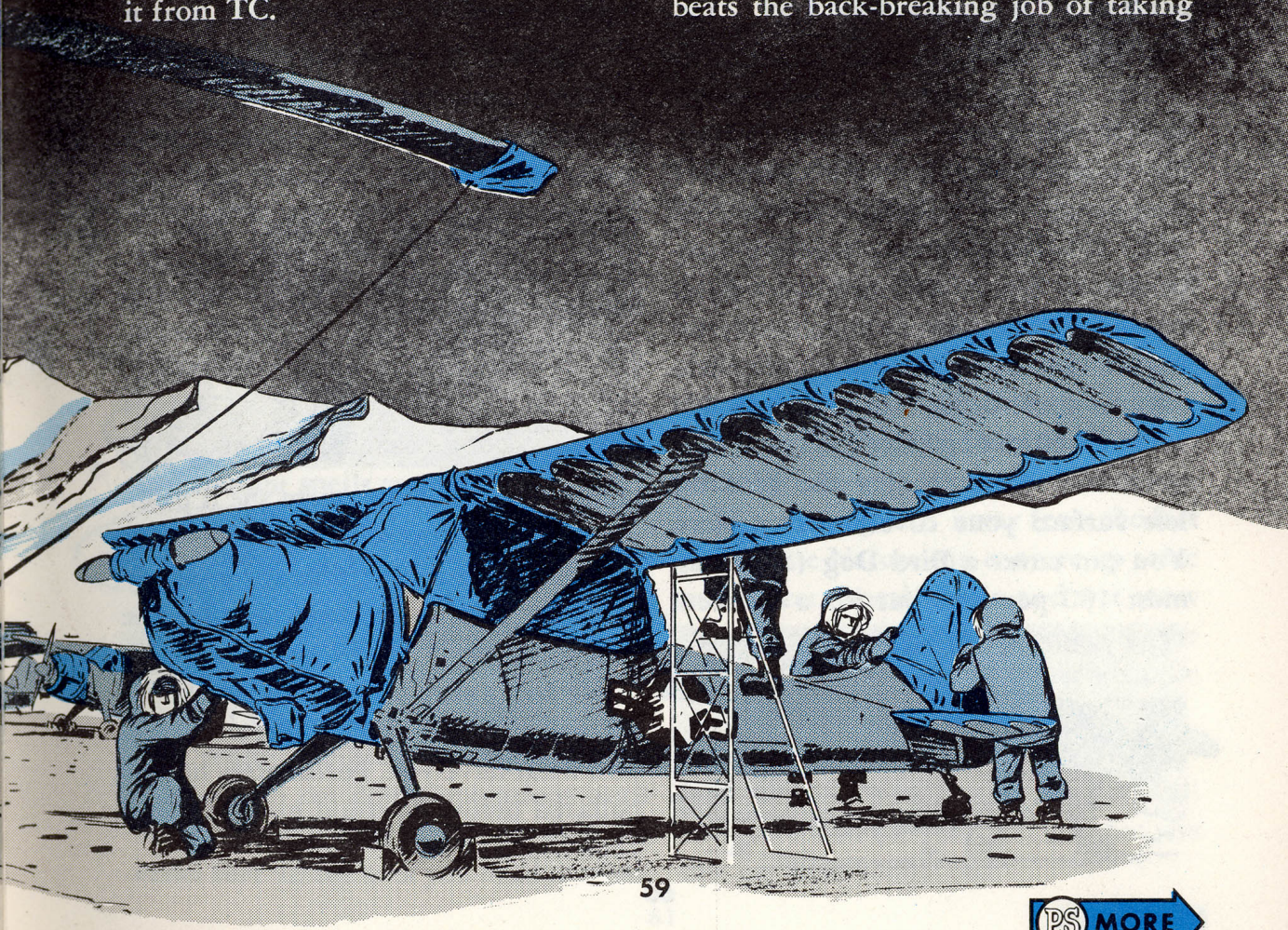
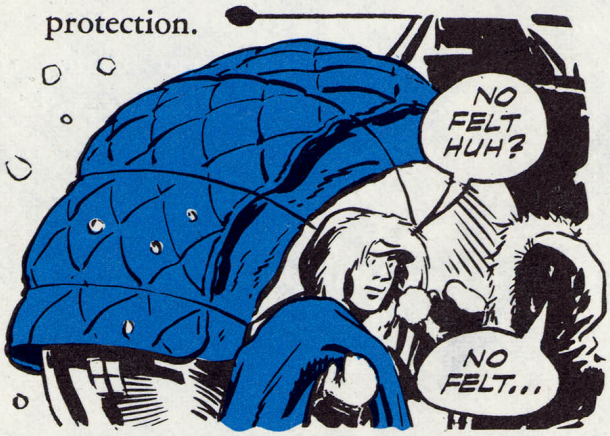


PS MORE

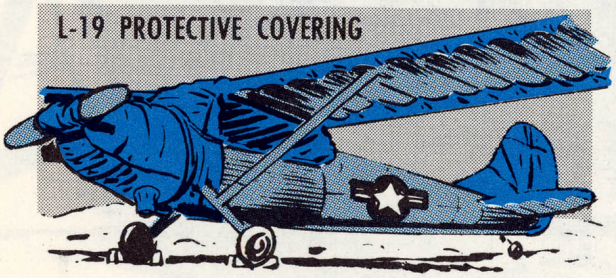
snow and ice off the bare metal every time. After you get your covers off be sure to wash them in soap and water and let them dry thoroughly. Covers put away dirty or wet go to pot right quick.

When covering a chopper it's a good idea to give the plexiglass special attention 'cause it can get scratched up real easy. You might use a layer of felt sheet under the covers for added protection.



Use all the covers you've got and they'll keep you out of a pack of trouble. In fact if you have a Raven (H-23) you should use tail rotor cover, FSN 1730-395-6521, in any freezing temperatures. Seems moisture has a habit of getting into the vent holes and freezing. It can throw the rotor out-of-balance in short order like it says in TM 1-1H-23-1015 (21 Feb 61).

Of course, the bigger the bird the less surface your covers will protect. You can cover a Bird Dog (L-19) almost 100 per cent but it's a different story, for example, with the Caribou (AC-1). Covering that big bird would be like trying to cover a football field.



But suppose your big bird's on standby for some big deal. The best way to keep a coverless bird clear in a storm is to keep the aircraft's surfaces wet with deicing fluid—one coat after another.

You get the most coverage with the least effort by spraying the fluid on your aircraft. If you don't have spraying equipment you can put the fluid on with a mop, broom, or soft-bristle brush.

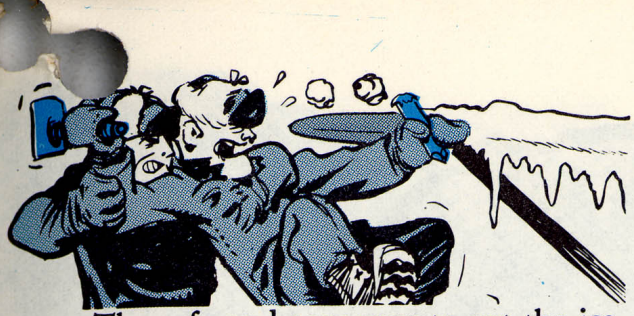
Another thing—if you have any wing walking to do when you put the fluid on, watch your step . . . that fluid is greased lightning under foot. Your best bet is to work from maintenance stands.

CLEAN SNOW OFF BIRD

When the snow begins to fall it can pile up fast. So sweep the snow off with a brush or broom as it builds up. Then

comes the end of the storm she'll probably only end up with a thin layer of ice. But this isn't the time for anybody to make like an ice man . . . like one type tried to.

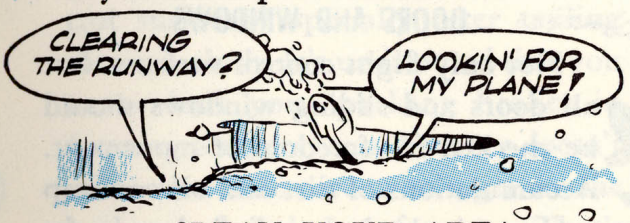
He had a sure-fire way to get the ice off using knives, picks, screw drivers and what-have-you. Fortunately he was collared before he could make his ship look like a sieve.



The safe and easy way to get the ice off the bird's skin is to use deicing fluid. If you're not in the boondocks, you can shove a bird undergoing maintenance out of a hangar and put your operational bird in there until it's **completely** dried out.

You shouldn't use scrapers either. They can scratch plexiglass somethin' fierce. If you're rushed for time and want to melt the ice with your portable heater, make sure you leave it in the bird until the area is bone dry. Otherwise water can drip and settle around hinges and control cables and refreeze later, either on the ground or at altitude.

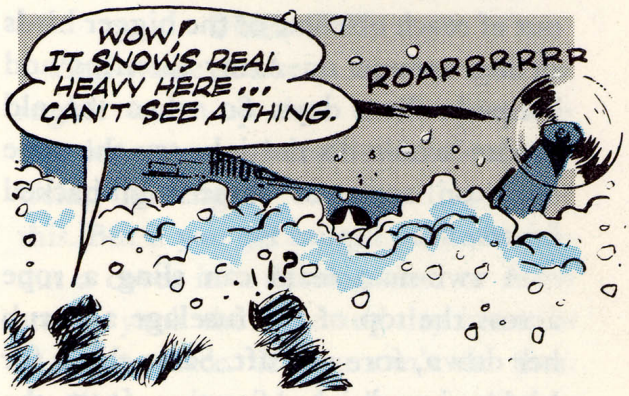
There's no compromising with ice, frost or snow. It's all gotta come off down to the bare metal. A quick-run-through of your operator's manual will clue you that the bird's airfoil has to be clean to get the needed lift for take-off. Taking off with even a light coating of snow, ice or frost could be like trying to get your M49C tank-truck airborne. When it comes to hoar frost, any amount spells trouble.



CLEAN YOUR AREA

A white blanket a coupla feet deep is bound to cut down operations until the plows dig into it. When they do, make sure all the area you need to move your aircraft around in is cleared—right off the bat. It's a lot tougher to clean up snow after its been melted by the sun and turns to ice. And don't settle for anything less than the cleanest job either.

Take your chopper site. It should get the clean sweep treatment 'specially if the snow is powdery. Crankin' up a chopper in this stuff can start a down-wash blizzard all by itself, blind the pilot and maybe cause an accident. If

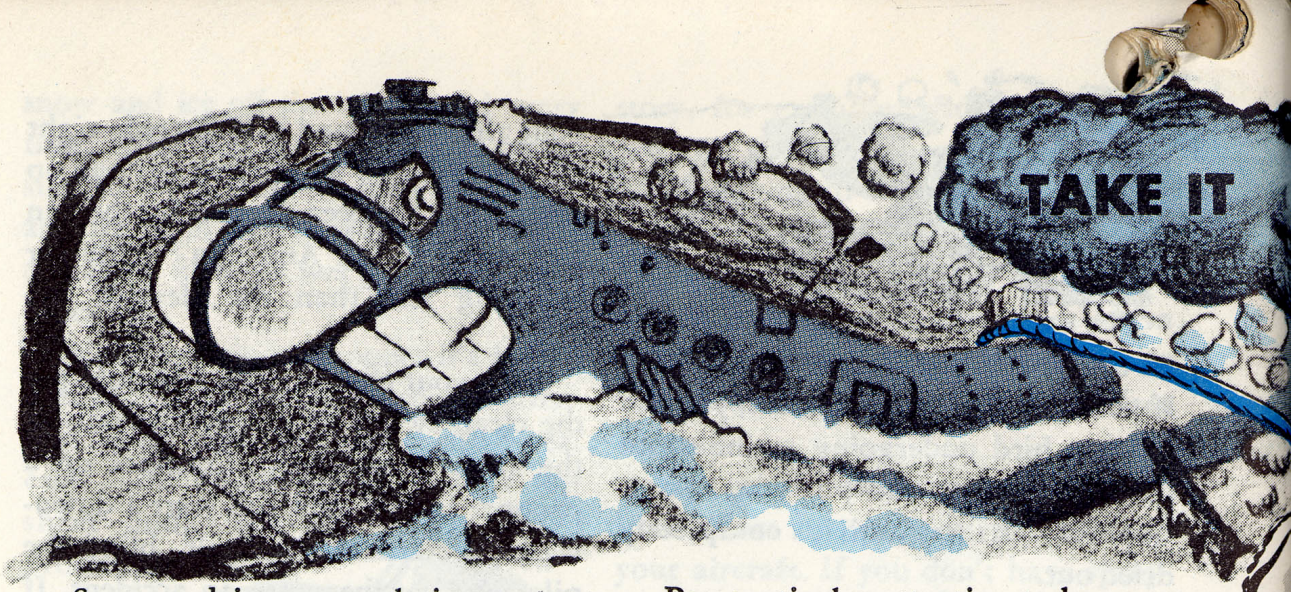


time is the number one concern you can run some tracked or other vehicles over the snow and pack it down enough to go on with flight operations.

Getting your fixed wing aircraft off the ground will take a little longer since the landing strip has to be plowed —unless you're in ski country. Again, don't settle for less than the best . . . and the sun will take care of the rest.

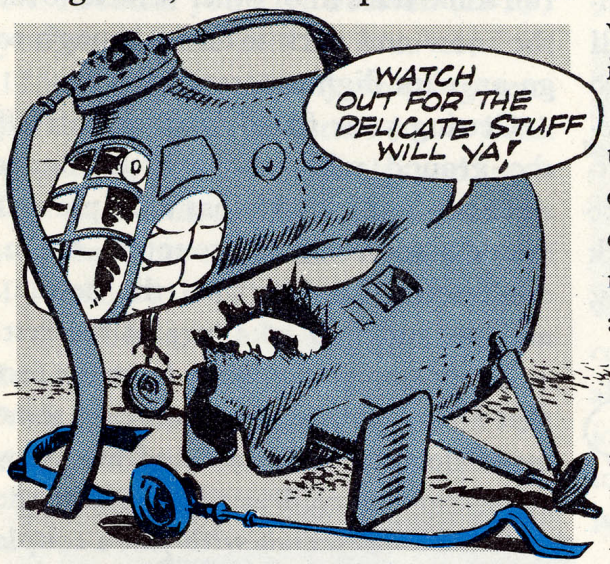
There's no gettin' away from the fact that Dame Nature can conjure up some mean sleet, freezing rain and wet snow storms in winter. But you can take the edge off the big ones with just a couple of preventive maintenance steps:

Keep one eye peeled for storm warning forecasts . . . and get together all the protection for your aircraft that you can lay your hands on.



Snow and ice accumulation can get out of reach on some of the bigger birds sitting around on Army airstrips and helipads these days. So when the old broom won't do the job, try the rope trick on some of these high-backed beasts.

A two-man team can sling a rope across the top of the fuselage and rub her down, fore and aft. Same thing for high winged jobs. Starting from the wing roots, work the rope fore and aft



while moving outboard to the tip. But watch out for items like external lights and antennas. It doesn't take much to bust up parts already made brittle by low temperatures.

Pay particular attention to how you treat the pitot head and tube assembly during snow removal . . . and keep in mind how easy you can damage it any time you're taking off or putting on aircraft covers.

It goes without saying that leaving even the slightest traces of snow or ice on those delicately balanced rotor blades and exposed control linkage is asking for trouble before you even leave the ground—if you can, that is, with the spoiler effect of frost, snow or ice canceling out blade lift.

With the Shawnee (H-21) in particular, you've got the added worry of keeping the rainshield cleared, or else cockpit and transmission heat will do the melting job for you in flight, with a swampy cockpit as the result.

DOORS AND WINDOWS

Not only flight control surfaces, but all doors and sliding windows should be checked for freedom of movement. Accumulations of dirt and oil can trap moisture in the door and window tracks and locking mechanisms. Even a weakened solution of leftover de-icing fluid can freeze in flight wherever you forget to remove the stuff.

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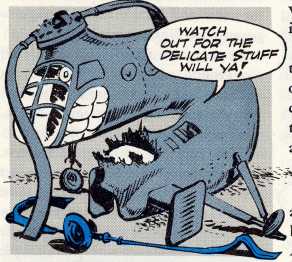

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Aircraft windows also deserve special attention in extreme cold. Heavy accumulations of frost may take a heck of a long time to remove by a slow, even application of heat—but it's better that way than a quick blast of hot air, which can crack or warp the glass or plexiglass. You can help things a little by learning to leave a window open, where possible, to equalize the inside and outside temperatures. This gives moisture less excuse to hang around windows.

LANDING GEAR

Movable parts of landing gears can freeze up even quicker than flight control surfaces, especially after taxiing through slush. It's understood that you never lock your parking brakes in freezing temperatures, but that doesn't mean that moisture won't get in the brakes and lock 'em for you. That's why some sort of wheel covering comes in handy.

Even with a combination landing gear, working brakes can be put to use in some cases by partially retracting the skis.

As for the rest of the landing gear, a cloth dampened with de-icing fluid—or even hydraulic fluid—should be used to wipe off all exposed operating surfaces, such as struts and pistons.

On retractable gear, ice on the ground or slush that freezes into ice at altitude can jam the actuating switches and leave you hung up—or down—or somewhere in between.

OTHER STUFF

And while you're at it, why wait for engine warm-up time to discover impact ice on your aircraft's air inlet filter. Using an engine cover will prevent this. But if you get caught parked without a cover in a driving sleet or snow storm, yank the filter and dry it out in a warm place. If you can't do that, you'll have to settle for heat applied to the exterior of the aircraft. But this won't guarantee you a completely dry filter.

A light coating of glycerine or de-icer fluid on Mohawk (AO-1) and Caribou (AC-1) de-icer boots is better than a lot. Excess amounts will just run off or thicken up. So just moisten a clean rag and wipe it on. Yeah, there're boots on the Seminoles (L-23), too. But they're already treated with a special cement, so please keep the ice-pickin' mittens off.

There are still more specific points that could be mentioned. But instead of going on and on, let's just say that as long as you get the idea, you'll know what areas to watch when ice and snow are making trouble for you.

Aircraft windows also deserve special attention in extreme cold. Heavy accumulations of frost may take a heck of a long time to remove by a slow, even application of heat—but it's better that way than a quick blast of hot air, which can crack or warp the glass or plexiglass. You can help things a little by learning to leave a window open, where possible, to equalize the inside and outside temperatures. This gives moisture less excuse to hang around windows.

LANDING GEAR

Movable parts of landing gears can freeze up even quicker than flight control surfaces, especially after taxiing through slush. It's understood that you never lock your parking brakes in freezing temperatures, but that doesn't mean that moisture won't get in the brakes and lock 'em for you. That's why some sort of wheel covering comes in handy.

Even with a combination landing gear, working brakes can be put to use in some cases by partially retracting the skis.

As for the rest of the landing gear, a cloth dampened with de-icing fluid—or even hydraulic fluid—should be used to wipe off all exposed operating surfaces, such as struts and pistons.

On retractable gear, ice on the ground or slush that freezes into ice at altitude can jam the actuating switches and leave you hung up—or down—or somewhere in between.

OTHER STUFF

And while you're at it, why wait for engine warm-up time to discover impact ice on your aircraft's air inlet filter. Using an engine cover will prevent this. But if you get caught parked without a cover in a driving sleet or snow storm, yank the filter and dry it out in a warm place. If you can't do that, you'll have to settle for heat applied to the exterior of the aircraft. But this won't guarantee you a completely dry filter.

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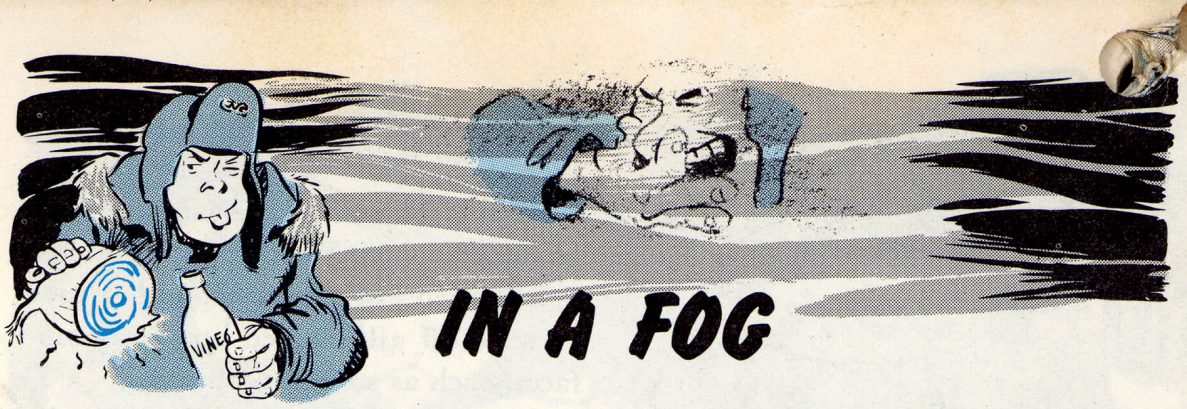


IN A FOG

Everybody's heard of one "home remedy" or another for keeping the fog off the windshield in cold weather. Some say take a slice of onion and run it over the windshield. Others say vinegar is the best bet.

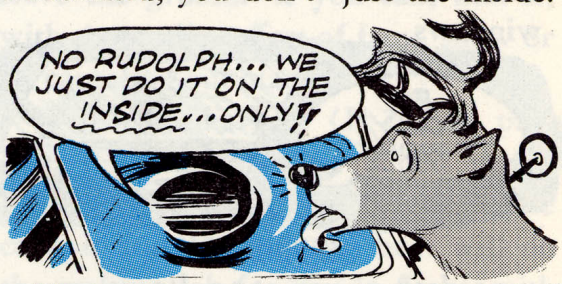
Then you'll find at least one guy in the outfit that has worked something out. Maybe he tapes a piece of plastic to the inside of the windshield.

Commercial antifogging compound is your best bet. Ask your Chemical Corps support people for it. They'll tell you what they have or what's available and authorized for local purchase.

Once you get your antifogging compound, you'll not have any problem using it. Naturally, if it comes in a squeeze bottle with a dispenser, then that's how you'll use it—squeeze.

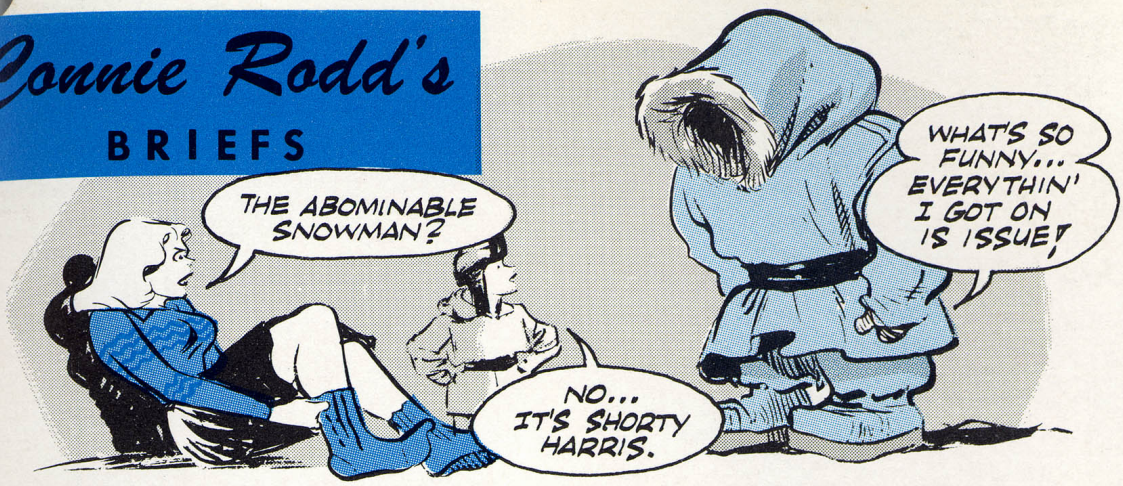
There's a little more to it than that though. When you're using it on your windshield for the **first time**, you spray it on—then wipe it dry with a soft cloth or soft tissue, pronto. Then you repeat the procedure—spray then wipe dry.

Now if you're wondering whether you spray both sides of your vehicle's windshield, you don't—just the inside.



There's something to keep in mind when you're antifogging your windshield. It'll protect it below freezing, but the temperature has to be above freezing when you put it on—maybe an inside job, huh? Do not—repeat, Do not—use any fog repellent on your plastic aircraft windshields or bubbles unless you're sure it conforms to Mil Spec MIL-K-6882. Many chemicals can't be used on those acrylic plastic aircraft windshields.

Connie Rodd's BRIEFS



No sweat here

You artillery men—don't let the A or B in the Mil Spec throw you when it comes to using the hydraulic fluids issued under FSN 9150-265-9412. It's strictly mox nix whether the spec reads Mil-H-6083A or Mil-H-6083B. The change has nothing to do with the quality—or the use—of the fluid.

Handy hawk hint

There's only one way you can run the coolant pump in your AN/MPQ-33 and 34 radar sets without the magnetron being connected to it—and still keep the pump from getting damaged. And that's by using a by-pass line between the maggie input and output hose connections. To do this, of course, you have to have a true-false radiate. In other words, the maggie wants to be completely out of the circuit electrically—the filament fuse pulled and circuit breaker off—that is.

Hawk missilemen

The Ordnance people want you to use one kind of desiccant in your missile container. That's the kind they have under FSN 6850-856-7955, with the nomenclature: Desiccant, activated. You get 18 bags of the stuff in a 5-gal can. Where's it listed? On page 8 of TM 9-1410-500-20P/1 (May 1962) . . . that's where.

Lamp for B-1 light

Any time the ¼ watt, type NE 45, neon lamp in your B-1 Ignition Timing Light (FSN 6625-255-1449) burns out—fear not. FSN 6240-179-1814 (Eng) will get you the replacement lamp.

M60 tank gun shield cover

Having trouble getting a gun shield cover for your M60 tank? This is an authorized item even though you won't find it in the current issue of the —20P. Ask for cover assembly, gun shield, FSN 2540-771-0663.

Light way to point

Finger pointing is not only bad manners—it's bad news around moving parts or electrical conductors. Wood or metal pointers aren't much safer, either. The preferred item for doin' some showin' is a narrow beam flashlight. Ask the man who knows . . . nine-finger Nick!

Pub conflict

Any time you find conflicting information in more than one publication, whether it be a TM, TB, LO, SB, MWO, or any Department of the Army publication, always remember . . . the info in the latest dated publication is the one that counts. AR 310-1 (May 1956), para 15 makes this a hard and fast rule.

Would You Stake Your Life on the Condition of Your Equipment?

BE READY
ANTI-
FREEZE
DE-ICE
COMPOUND,
BROOM
FOR THE
BIG FREEZE